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A MODEL ELECTRIC RAILWAY.

Robert Gibson Griswold.

I. TRUCK AND BODY.

With this chapter begins the description of a model electric railroad complete in every detail. As far as possible the general form of the equipment in use on the modern roads will be followed with such modifications introduced as will render the construction easy for the amateur. The making of an exact model, complete in each and every detail is very tedious and does not always warrant the immense outlay in labor.

The power used to operate this model road is derived from a battery of three or four good cells, such as the bichromate of potash type. A method will also be given whereby the ordinary 110 volts light circuit may be used by inserting a rheostat in series, and also from a model dynamo.

The road is of the third rail type which lends itself to simple construction while at the same time it is very substantial and all connections are in plain sight and easily made.

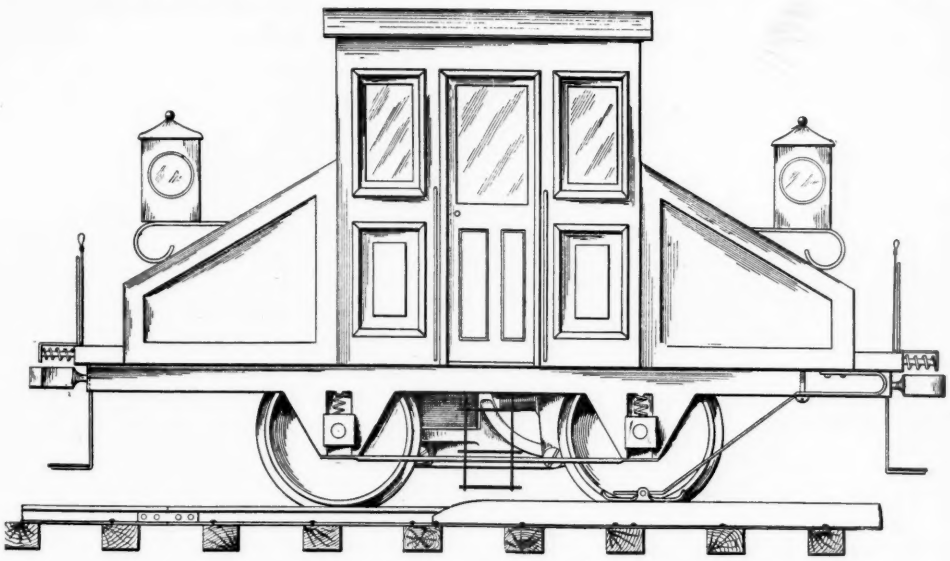


Fig. 1

We will begin with a model electric locomotive of the type in such general use in engineering works and mines. The outward appearance of

the locomotive is shown in Fig. 1, while in Fig. 2 is shown the side elevation giving the assembled detail. Fig. 3 gives the end elevation together with some detail.

The frame 1 is built up of brass soldered together at the ends so as to form a rigid whole. Make two sides 1 as shown in the detail drawing Fig. 4 from No. 20 B. W. G. hard sheet brass or sheet steel. Lay off the entire side as shown, then cut out as neatly as possible with a pair of tinner's shears, or snips. Finish dressing to actual dimensions by means of a file, exercising care to keep the sides of the journal box guides truly parallel. The small projection *a* at the top of this provides means for securing the spring in place. The small projections *b* are provided to fasten the tie rod to the truck frame.

The sides, which fit over the pedestals and slide up and down thereon, may be cut in with a hack-saw and finished smooth with a very thin knife file, These blocks must slide freely in their guides but should not be so loose as to shake. The hole *e* for the journal should be a trifle larger than the journal itself, to prevent binding should an uneven place in the truck cause either side to raise or lower these blocks.

The small springs 4 should be made of No. 28 spring brass wire coiled about a wire nail about $\frac{1}{8}$" diameter. If these springs are made too small in diameter they will be stiff and will not yield to the irregularities in the truck. One end of the wire must be bent in towards the middle and then at right angles so as to fit into a small hole *f* drilled in the top of each block 3.

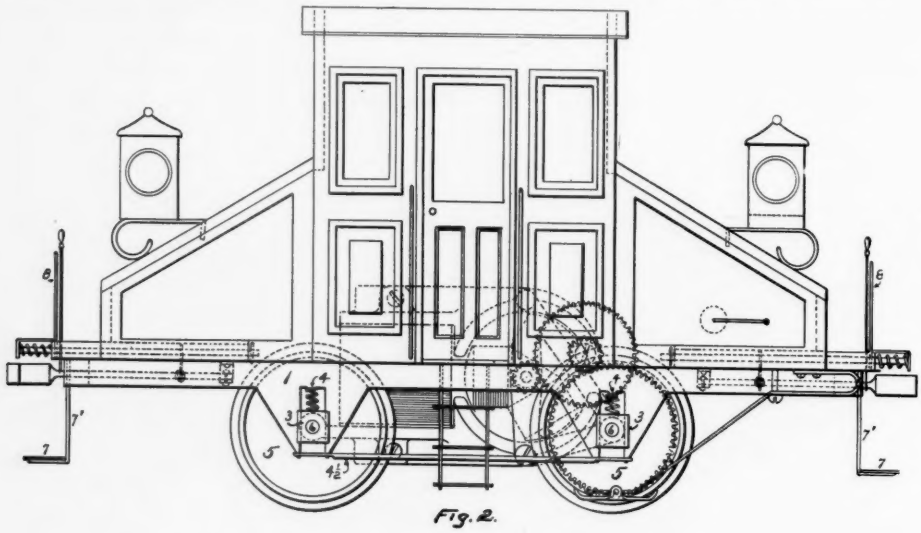


Fig. 2.

The ends of the frames 2, are made of strips of brass of the same gauge as 1, having the ends bent at right angles as shown. These pieces are soldered in between the ends of the sides 1 so as to form an oblong truck frame. The small lugs *c* on side 1 are bent inwards to an angle of 90° to provide means for securing the body to the truck by small screws.

The journal boxes 3 are cut from $\frac{1}{8}$" brass strips and dressed to size by filing. The grooves *d* in

Extending from pedestal to pedestal is a tie-rod 5 made from a piece of No. 10 brass wire, the ends of which have been flattened and drilled so as to pass over the projections *b* on the ends of the pedestals. Do not fasten this tie rod in place until the wheels and motor are ready for assembling. In assembling the truck see that the sides are parallel. A good plan to follow is to cut out a block of wood whose dimensions are exactly those of the inside of the frame and after secur-

ing the frame to the block by a few tacks as indicated in Fig. 5 solder the ends *a*. To facilitate this operation, first coat the ends of the strips to be joined with a very thin layer of solder, and then when placed in position, a hot iron held on the outside of the strip will melt the solder and firmly join the two pieces when cold. Cut the corners of the block so as to accomodate the turned in portions of the ends as at *b*.

The wheels 5 should be cast of brass, although iron or lead may be used but the latter is too soft unless the lead has antimony added to it. Make the pattern of cherry allowing sufficient metal on the tread of the wheel to allow for finishing to size. A few words of advice for those unfamiliar with lathe work of this character may be of value here. Chuck the wheel so that it runs as true as possible with reference to the flange and tread. Now drill a $\frac{1}{8}''$ hole in the centre for the axle. Take a piece of $\frac{1}{4}''$ or $\frac{3}{8}''$ round steel about 3" long and turn down one end so that it just fits in the hole drilled when driven, giving it a very slight taper. This forms a mandrel for turning the wheels, and when so finished they will run true on the axle. Drive the wheel on the mandrel by placing on a hard wood block and swing between

The axles 6 may be made of $\frac{1}{8}''$ brass, steel or iron wire, but should be perfectly straight. No particular work is required beyond cutting to

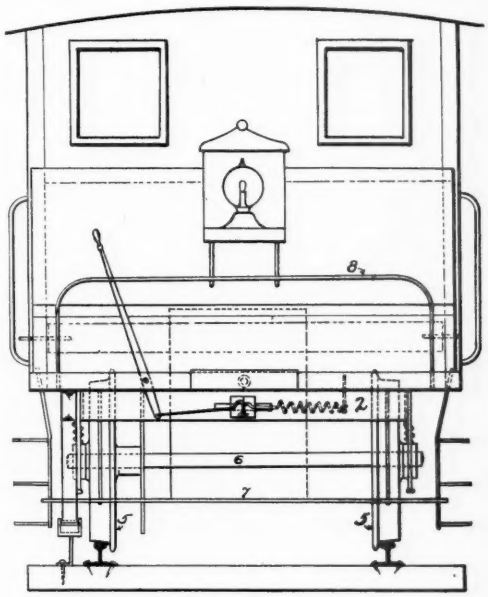


Fig. 3.

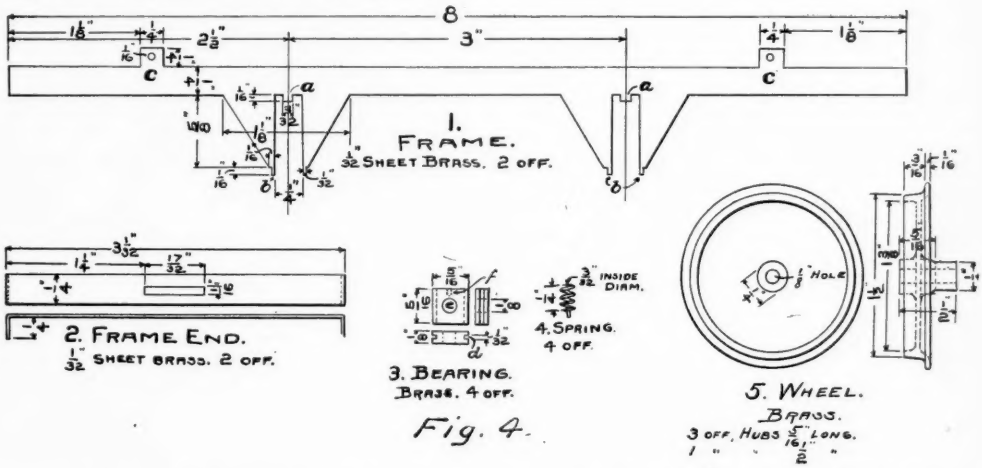


Fig. 4.

centres as shown in Fig. 6. Take a light cut and the wheels will hold without slipping. Make the treads slightly beveled as shown, and smooth the flanges where they bear against the rails; as this will greatly reduce the tendency to chuck, especially in crossing switches and frogs. Face the hubs to dimensions given.

proper length and straightening. If drill rod can be secured, nothing better can be desired as it is straight and true. The wheels cannot be mounted until after the motor and motor bearings are finished as these also are strung on the axles.

Upon the construction of the body of the locomotive, and its decoration, depends much of the

appearance of the outfit. While it may be made of tin properly soldered together, a much finer job can be made of wood. Nothing adds so much to the appearanee of a model as proper attention to details in the decoration.

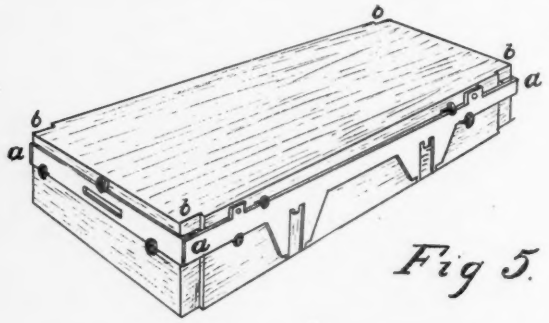
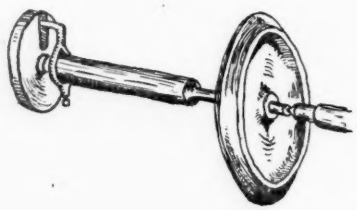


Fig 5.

Fig 6.



After cutting the spaces for windows provide a door or properly line the space with a neat frame or jamb. Two small steps may be attached just below the door as shown, and the two small hand rails fastened to the door-jambs. The dimensions of the body are given in Fig. 7, and it is secured to the truck by screws passing through the lugs *c* on the frame sides.

At the ends of the truck are shown two foot strips supported by L shaped pieces made from No. 14 brass wire soldered to the frame. Across the lower ends is supported the step itself, being soldered thereto if of metal. If of wood the L shaped ends are inserted into holes in the edge of the step. The hand rails 8 are also bent out of No. 14 brass wire and inserted in holes in the strip 10.

The head lights 9 are to be provided with small pea electric lamps, and lit from the same circuit that operates the cars. The wiring diagram will be given later when that for the motor is described.

Make the lamp boxes of wood or sheet metal, providing the sides of each box with a small pane of red glass, leaving the fronts open; directly back of the small lamp glue a small piece of a mirror to act as a reflector. Make the bottom of the lamp of a piece of wood $\frac{1}{4}''$ thick and drill a small hole in the centre. Moisten some plaster of Paris until it forms a thick paste and build a small cone on the top of which mount the lamp, the wires passing down through the bottom and thence into the body of the car.

TESTING PHOTOGRHIC PLATES

A. Rothwell

It too frequently happens that some scene admired for its beauty, composition and effect of light and shadow, upon development turns out to be nothing but a mass of black and white. The delicate detail through the whole range has been lost, those bordering on the high lights are merged into one mass of white, while those running into the shadows are black. The result is that one condemns the plate rather than his own judgment.

Nature abounds in colors which emit feeble radiations or very little actinic light, and under a normal exposure do not affect an ordinary plate or film. Hence to correctly secure a proper graduation of color effects in a negative it becomes necessary to use a ray filter, or a plate sensitive to feeble radiations, or as is generally termed, color sensitive.

Fig. 1, is intended to represent the spectrum; red, orange, yellow, green, blue, violet. Fig. 2,

represents the light effect with a normal exposure on an ordinary plate, showing the region in which the light action is the strongest; also showing that only a small portion of light graduations of the view has been obtained. Fig. 3 shows the light effect on a plate which has been stained, or where the coloring matter has been incorporated with the gelatine. This shows a greater range of sensitiveness in which the region of the yellow is the most pronounced.

FIG. 1.

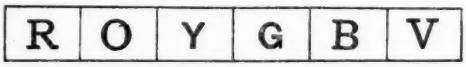


FIG. 2.

FIG. 3.

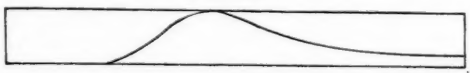
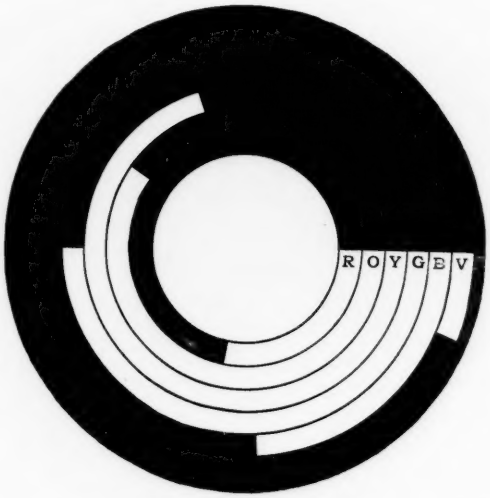


FIG. 4.



The blue and the violet reflect the most actinic light; the yellow the least, yet the yellow has the greatest luminosity. The action on the plate is the reverse of that desired, and it is to overcome this condition that we direct our efforts.

There is no better way of gaining knowledge than by experiment. Knowledge so gained is never lost, and the best means to prepare one to give judgment.

There are several methods of acquiring this knowledge. The more scientific is by the aid of the spectroscope, but as this is expensive, only those of means can avail themselves of this method. There is, however, a simpler way that answers admirably. The luminosities of the colors have been determined by scientists, and are represented in relation to that of white taken as one hundred. They are here given, together with the proportionate part of the arc of a circle.

Color	Luminosity	Degree of circle.
White	100	360
Red	28	101
Orange	60	216
Yellow	70	252
Green	50	180
Blue	24	86
Violet	6	21

From the above we can now make from a piece of stiff, white card-board Fig. 4, filling in the white spaces with their respective colors as indicated; the rest of the diagram, except the white centre, to be made of dead black. The color disk may now be fastened on a spindle of a small motor and rapidly revolved. While in motion it will have the appearance of circular bands of equal actinic luminosity.

To test any or all brands of plates, exposures are made with them upon this revolving disk, the light being thrown upon it so as to reflect towards the camera. An examination of the negatives so obtained will enable you to determine which plate is best adapted to the purpose you have in view, also, whether a ray filter has any advantages for any particular plate.

Mr. Edison announces that after years of experiment he has successfully completed a commercial phonograph. The new machine is capable of taking testimony in a court of justice, and will record from dictation. It is said that with a pair of machines, one for recording and the other for reproducing, a single operator can do the work of eight under the present system.

WOOD TURNING FOR AMATEURS.

F. W. Putnam, Instructor Manual Training School, Lowell, Mass.

XII. EXERCISES IN ORNAMENTAL TURNING.

PLANT STOOL.

Fig. 96 is a sketch of a plant stool, designed by Wm. Westcott, of the Malden Manual Training School, to whom I am indebted for the design. For lack of space, a half drawing only is shown, but sufficient dimensions are given, so that no trouble should be experienced in its construction. The centre lines are shown in this drawing and are lettered *C-L*.

The stool, which may be made from straight grained ash, plain oak or quartered oak, is made up of eight pieces; one centre spindle *A*, three connecting spindles *B*, three standards *C*, and the top *D*. All the pieces but the top, which is turned on the face plate, are turned between centres. The turning tools must be kept very sharp for this exercise, as the fillets, quarter rounds, quarter hollows, etc., are, most of them, very small and require considerable care in turning to avoid their "breaking out." For the small quarter and half hollows, $\frac{1}{8}''$ round nose chisel should be used. A $\frac{1}{8}''$ carpenter's chisel can be ground down for this purpose or, if this is not easily obtainable, the tang of a file can be ground down, care being taken not to grind off too large a bevel on the under side of the tang. For works of this character involving scraping, remember to keep the tool perfectly flat on the rest, the cutting edge coming exactly on a line with the centre of the work. The following is a table of the sizes of stock needed for this exercise.

A — 1 piece 5 $\frac{1}{2}''$ long, 1 $\frac{1}{4}''$ square.
B — 3 pieces 5 $\frac{1}{2}''$ „ $\frac{5}{16}$ „
C — 3 „ 12 $\frac{1}{2}''$ „ 1 $\frac{1}{2}''$ „
D — 1 piece 10 $\frac{3}{16}''$ diameter, 1″ thick.

No special directions are necessary for the turning of these various pieces, and I shall therefore confine myself to a few suggestions on the putting together of the various parts. Three holes, $\frac{7}{16}''$ deep are to be bored in the centre spindle *A* to receive the connecting spindles *B*. These holes must be such a size that the ends of the spindles *B* will fit tightly in them. These ends, if turned accurately, should be exactly $\frac{1}{2}''$ in diameter, but to make certain that the holes are of the desired size first bore a $\frac{1}{2}''$ hole in a pine block and test the ends of the spindles. If the ends of the spindles are too large file them down carefully to the required size. If the ends have been turned under size, smaller holes must be bored, and the ends made to fit these holes.

These three holes that are to be bored in the centre spindle must be equally spaced on the circumference or 120° apart. On a piece of paper draw a circle 1 $\frac{1}{8}''$ in diameter, and having constructed an angle of 120° set a pair of dividers to the required distance, and space off this distance on the centre spindle, thus dividing the circumference into three equal parts.

A hole 3 $\frac{1}{2}''$ deep is next to be bored in each standard to receive the other end of the spindle *B*. These holes must be bored so that the ends of the spindles will fit in them tightly. It will be noticed that the standards are to make angles of 75° with the top, and the connecting spindles are to make angles of 75° with the standards. Cut one end of a block so that it will make an angle of 75° with a straight side, this block to be used against the bit when the hole is bored. The 75° can be constructed by bisecting a 30° angle, thus giving 15° and adding this 15° to 60°, thus making the required angle of 75°. In boring the holes both the centre spindle and the standards must be placed between two thin pieces of pine and clamped in the wire or held in a 90° crotch cut out of a thick block.

Three holes $\frac{5}{8}''$ deep are to be bored in the bottom surface of the top to hold the ends of the standards. Mark a circle of 3 $\frac{1}{8}''$ radius on this bottom surface and on the circumference of this circle mark out three points 120° apart. These

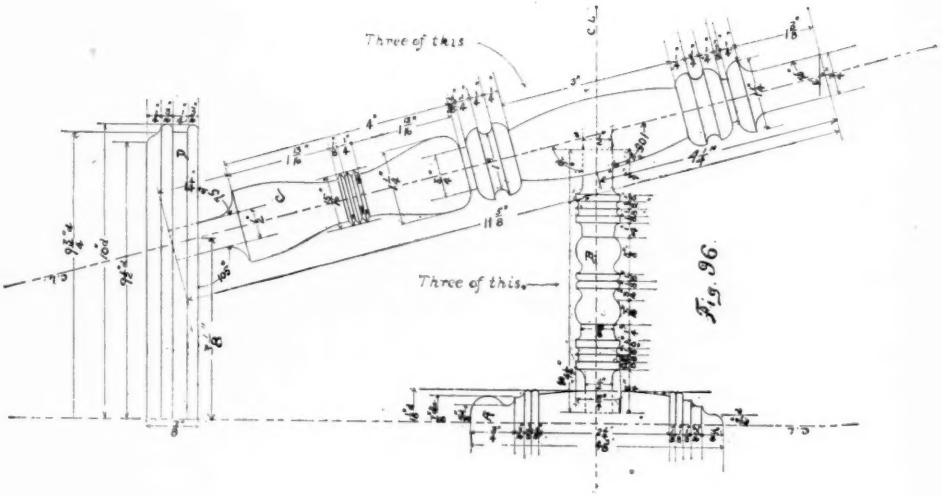


Fig. 96

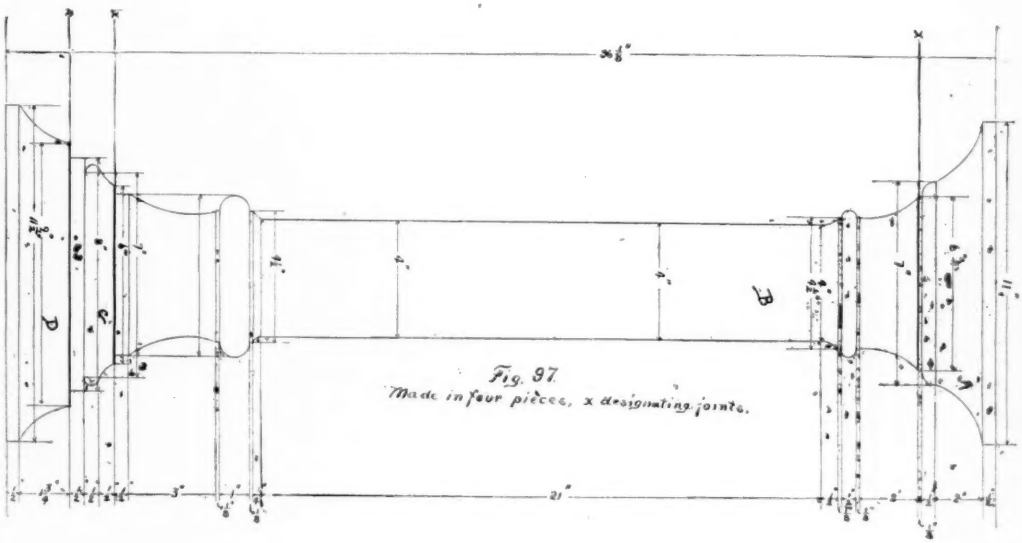


Fig. 97.
Made in four pieces, x designating joints.

points will be the centre of the required holes. When all the holes have been bored, and the pieces are ready to be put together, proceed as follows:—

Gluesize the ends of the spindles *B* and the ends of the standards with hot cabinet makers' glue. When this has been wiped off apply a heavy second coat to the ends of the spindles *B*, forcing the ends first into the holes of the centre spindle and then the other ends into the holes in the standards. As these ends are to fit tightly into the holes it will be well to bevel the ends slightly so that they will enter the holes readily. Next, lay the top down on the bench and glue and drive the ends of the standards into the holes made to receive them. Turn the stool over and put a heavy weight on the top. Next tie a heavy cord around the legs at the point where the spindles enter the standards, insert a stick and twist this in exactly the same manner as a tourniquet is twisted. Before the cord is tightened, make sure that the spindles *B* are exactly horizontal and the centre spindle *A* is vertical. If the cord is strong enough to withstand this strain, it will be found that the spindles have been forced into the centre spindles and the standards far enough so that when the glue has set and become hard the stool will be found to be very rigid, much more so than one might suppose. This cord should be kept tight and the weight kept on the top until the glue is thoroughly hard. If any difficulty is experienced in making the standards fit firmly in the top, 1″ No. 16 steel wire brads may be driven through the ends of the standards into the top, but this ought not to be necessary if the holes are bored to the proper depth and the ends of the standards made to fit the holes tightly.

The bottom ends of the standards are cut off at an angle of 75°, a spirit level being placed on the top to make sure that the plant stool stands level. The stool may be stained or filled and varnished, following the directions given in the last chapter.

PEDESTAL.

The pedestal shown in Fig. 97 is the original design of Herbert W. Home, a student at the Lowell Manual Training School. It requires a large lathe, probably larger than is in the possession of many amateurs, but little difficulty should be experienced however in designing a smaller pedestal of the same general shape as the model shown. The pedestal is made in four pieces, the joints being shown at *X*. The top *A*, the collar *C*, and the base *D*, are all turned on the face plate, while the shaft *B* is turned between centres or preferably in a way to be described later. This pedestal may be turned from oak, plain or quartered, or white or red birch and stained to imitate mahogany. If one can afford mahogany a very beautiful pedestal can be made following this design.

The shaft *B* which is 6″ in diameter, and 29 $\frac{1}{4}$″ long, had better be glued up from four pieces, 30″ long, 6 $\frac{1}{4}$″ wide and 1 $\frac{9}{16}$″ thick. Great care must be taken in selecting stock to secure pieces that are absolutely dry and free from checks. Generally it will be found to be next to impossible to secure a piece of oak or birch 6″ thick, that is absolutely free from checks, and it will also be found to be difficult to find a plank 3″ thick that is perfectly free from checks, so that I advise the use of plank 1 $\frac{5}{8}$″ or 1 $\frac{3}{4}$″ thick. Two of the pieces should be trued up carefully on both sides and the other two pieces on one surface each. The two centre boards may be glued and doweled together with $\frac{3}{8}$″ dowels, or wood screws may be used instead of the dowels. The two outside boards are to be glued and doweled to the centre boards, care being taken in boring the holes in the outside boards for the dowels, not to bore too deep, as the dowels must not show on the finished shaft. Hot cabinet makers' glue must be used, and the pieces must be clamped together tightly with at least eight clamps. The block for this shaft is so heavy that I advise fastening the face plate with heavy screws to one end of the block. Fasten to the other end a circular piece of oak 5 $\frac{3}{4}$″ in diameter and about 1″ thick with heavy wood screws. Drive a long wire nail through the centre of the round block; having marked the centre of the end of the shaft, drive this nail a short way into the end of the shaft at the centre point, and fasten the block to the shaft with screws.

Next remove the nail; the nail hole will serve as the centre for that end of the shaft, the spur of the tail centre being inserted in this hole. In this way the shaft can be mounted in the lathe

so that there should be no possible chance for the joints of the shaft to open. Before starting to turn the shaft, remove the edges of the block with a draw shave or heavy chisel. The lathe must be run at the slowest speed until the block has been reduced to a cylindrical form.

Great care must be taken to fasten the rest rigidly to the shears, and also the tee to the tee holder, as the lathe will vibrate considerably until the block has been turned down to the cylindrical form. In sandpapering the shaft use No. 1 ½″ finishing with No. O. The shaft must be sandpapered until it is absolutely smooth and free from rough spots.

No directions should be necessary for the turning of the other pieces. When the pieces are ready for assembling proceed as follows:

Fasten the collar *C* to the shaft with four 2 ½″ No. 12 wood screws. Next, fasten the base *D* to the collar *C* with four 2 ½″ No. 12 screws, the heads being countersunk ¾″. The top *A* may be fastened to the shaft in two ways. The first way is to use four ⅜″ dowels, the dowels extending 1 ½″ into the top. The only difficuity comes in getting the four holes in the top exactly opposite those in the shaft. This can be readily done however in the following manner: —Mark a circle on the top surface of the shaft and one on the bottom surface of the top, both circles being 4″ in diameter. Mark off on the circumference of the circles four points, each exactly 90° apart. These points are the centres of the required holes and there remains only the boring of the holes, which must be absolutely straight.

The second method makes use of a 3″ joint screw. This screw has the regular wood screw thread at each end, one end having a right hand and the other a left hand screw thread.

The screw is to be placed in the centre of the shaft. A small hole to receive the screw should be bored in the end of the shaft and also the top. Turn this joint screw into the shaft for a little more than half its length and then turn the top on to the screw. The shaft must be held firmly in the vise while this is being done, thin pieces of pine with a padding of cloth or waste being placed against the jaws of the vise so as to avoid any possible bruising of the shaft. This joint screw must be rather large in diameter so as not to twist off when the top is turned on, care must also be taken in turning the joint screw to keep it straight, for if it became bent it would be very liable to twist off when the top was turned on.

All the joints must be given a heavy coating of hot glue, all excess of glue being immediately wiped off where joint has been fastened.

WOODEN CLOCK MOVEMENT.

J. H. Hackelton

The clock movement here described is of a size suitable for the "Colonial" and "Old Dutch" clock cases described in the December, 1902, February. 1903, and July, 1903, issues of Amateur Work. It is to be made of wood, with the exception of the scape wheel, which is made of brass. It is absolutely necessary that the location of all holes for bearings, called the "dipthings," and dimensions of all gears, including the size and shape of the teeth of same, be perfectly accurate; as the successful working of the movement depends upon this. Otherwise you may find that the clock will stop without apparent reason, and locating the cause will be difficult owing to the number of parts.

For the frame, two pieces of clear grained maple or birch, 10″ long, 8″ wide, and $\frac{3}{16}$″ thick will be required. They should be thoroughly seasoned and planed perfectly smooth. Then fasten together with two small screws, preparatory to drilling the holes for pivots, etc. The location of the holes is shown in Fig. 1 and they must be carefully laid off on these boards with dividers, testing the holes carefully to see if accurately spaced. Then drill the pivot holes, using a No. 30 twist drill in a small hand drill having a chuck suitable for holding twist drills. To make sure that the drill will not work to one side when starting a hole, it is well to first punch a hole with a scratch point, deep enough so the drill will follow true. Also

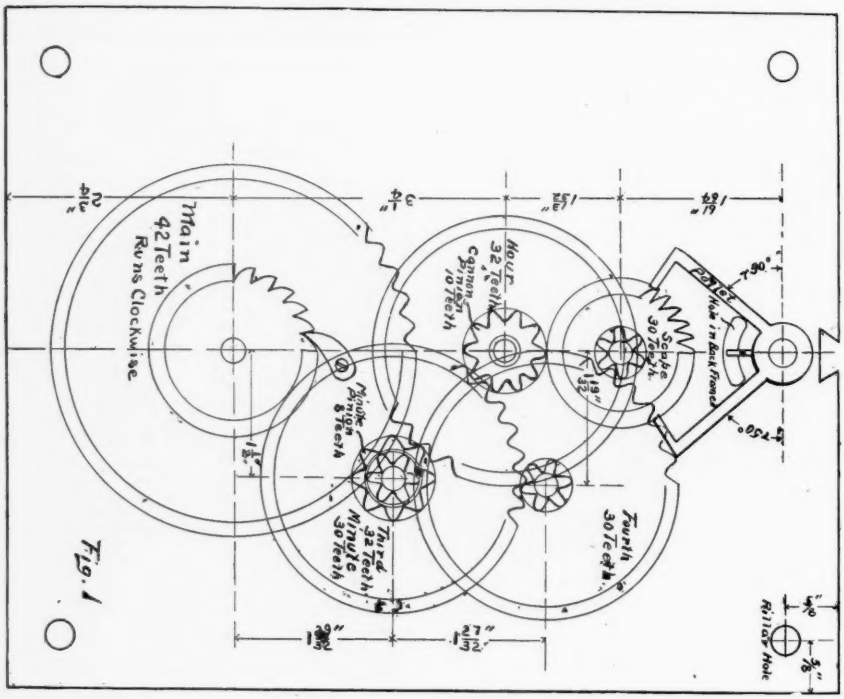


Fig. 1

WOODEN CLOCK MOVEMENT. SCALE, ONE HALF SIZE.

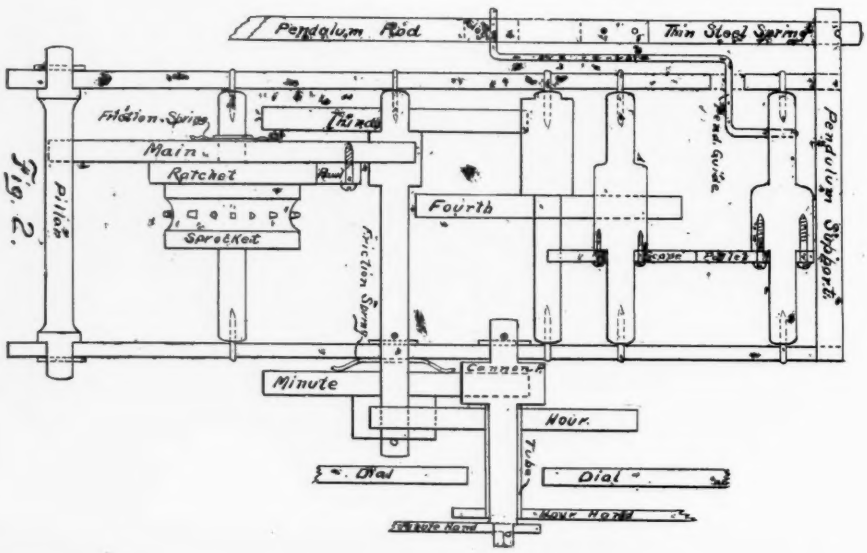


Fig. 2.

see that the holes are drilled square with the boards, so that the dipthings will be the same in both boards.

Four pillars are needed, one at each corner of the frame. These are made in the shape shown in Fig. 2. These can most easily be made by turning in a lathe, if one is available; in fact a lathe would make easy much of the work in making the movement. If no lathe is at hand, the pillars can be shaped out of round pieces, with a flat file have a "safe edge".

Next we come to the wheels, or technically speaking the train. The first or "main" wheel, shown in Fig. 2 has three functions: it contains the drum for winding the chain holding the weight; on the end of the drum is the ratchet for retaining the drum when the weight is wound up; and the wheel itself which runs into the centre pinion. This wheel is 4 $\frac{3}{8}$" outside diameter, and 4 $\frac{1}{16}$" diameter at bottom of teeth, with a $\frac{5}{16}$" arbor hole in the centre.

The main and other wooden wheels are made of pieces of selected maple, $\frac{1}{4}$" thick, sawed end to the grain, that is, the grain runs parallel to the axis of the wheel. The hole in the centre is bored first, then a plug is put in the hole and the circumference marked with dividers. It is then mounted on an arbor and turned down or jiged out with a fret saw and filed perfectly round. The teeth are then marked out using a hard, sharp pointed pencil so as to get fine lines. Then with a knife-blade file, the teeth are filed out. If care is used, a fret saw may be used to remove the wood between the teeth, finishing with the file. A templet for the teeth of each wheel should be made of thin brass, that all the teeth may be of uniform shape and size.

As the main wheel has the 42 teeth the circumference can easily be divided into six equal parts, the radius being one sixth the circumference. A few trials on a piece of white paper, will soon secure the correct space for seven sub-divisions. Or a card board pattern can be made, using care to see that the arbor hole is exactly in the centre. The third wheel is 3 $\frac{3}{16}$" outside diameter, and 2 $\frac{7}{8}$" short diameter, with 32 teeth, the arbor hole being $\frac{5}{16}$". The hour wheel is of same diameter size and number of teeth as the third wheel. The fourth and minute wheels are of same size s the third and hour wheels, but have 30 teeth.

The staffs or pinion arbors are next to be made. The pinions and staffs should each be made of one piece for the third, fourth, scape minute and cannon pinions. The hour wheel can be fitted on a piece of thin brass tubing, the winding wheel is put on the arbor friction tight to allow winding. The ratchet chain wheel and staff are one piece, and also the pallet arbor, as shown in Fig. 2. The arbors shonld fit loosely between the frames allowing a little "end shake" to avoid friction which would retard the motion of the works. The ends should be very smooth for the same reason.

If a lathe is available, it would be well to first fit the pivots to the staffs before turning, as then the pivots would surely be correctly centered. Without a lathe, the centres can be located with dividers, and the hole for the pivots drilled with a twist drill. The pivots are made of steel wire cut into pieces about $\frac{5}{8}$" long, the ends sharpened with a file, and then driven in till they project about $\frac{1}{4}$" or so as to go through the frame.

Below the pivot hole of the pallet a hole is cut in the back frame for the pendulum guide to project through. In the centre of, and across the top from the front and back piece, the pendulum support is fitted. It is a piece of strong hard wood 4 $\frac{1}{4}$" long, $\frac{1}{2}$" wide and $\frac{1}{4}$" thick, the ends being dove-tailed into the frames. A vertical slot is cut in the rear end with a saw to receive the spring of the pendulum. On the top side a narrow slot is cut for the wire nail which is put through the hole in the pendulum spring, thus holding up the pendulum and keeping the end in place.

The pendulum rod is of clean oak 38" long, $\frac{1}{2}$" wide, and $\frac{1}{4}$" thick. To the upper end is pinned a piece of thin, spring steel 4" long, and $\frac{1}{4}$" wide, holes being drilled for two pins made of wire nails cut off to the right length. A vertical slot is cut in the centre of the rod, 5" from the top of pendulum support, for the end of the pendulum guide to play in. The pendulum guide is of steel wire bent to the shape shown in Fig. 2, a hole being drilled in the pallet arbor to receive that end with a drive fit.

The scape wheel is made of hard brass $\frac{1}{8}$" thick and is 1 $\frac{3}{4}$" outside diameter. It has 30 teeth, of a little different shape from the others as shown by Fig. 1. In addition to the $\frac{5}{16}$" arbor hole in

the centre, two small holes are drilled to receive the round head brass screws used to fasten the wheel to the arbor. The pallet is also cut out of hard brass $\frac{1}{8}$″ thick in the shape shown in Fig. 1. When about complete, the pallet and scape should be tried to see if the contact and clearance is correct. This cannot well be described, but can easily be understood by a little study and experiment.

The ratchet wheel is 2″ diameter with 24 teeth of the shape shown in Fig. 1. A brass pawl, attached to the main wheel with a round head screw prevents the ratchet from turning in but one direction. The sprocket wheel for the weight chain is 1 $\frac{5}{8}$″ diameter, $\frac{3}{4}$″ thick with a $\frac{3}{8}$″ rounded slot cut around the centre as in Fig. 2. The sprocket points are made by driving in wire nails and then filing off to correct length. The spacing of these points is regulated by the size of links of chain used which should be brass with a flat, square link, a piece about 6′ long being needed. One end of the chain is attached to the weight which will be about 10 pounds but varies with the clock and may be a little more or less, than this. The weight is on the small hour side of the ratchet.

The pendulum bob is made of a disc of wood, rounded on the front face, and weighted with lead on the back to about one half pound. This may also require some adjusting to secure good results. It is attached to the rod by means of a spring bent to fit around the rod, friction tight and screwed to bob.

As before mentioned, the hour wheel is mounted on a piece of thin brass tubing which should be an easy fit to the arbor of the pinion turning the minute hand. The hands are cut out of thin wood, white holly presenting a fine appearance if over a dark back ground. The figures of the dial are left to the taste of the builder.

The friction springs of the minute and main wheels are made of spring brass, of triangular shape with holes in the centre to fit easily over the staffs, the points being turned outward and all burr removed to prevent undue wear of the wheels upon which they press.

A SIMPLE TURNING LATHE.

III. BED AND POWER.

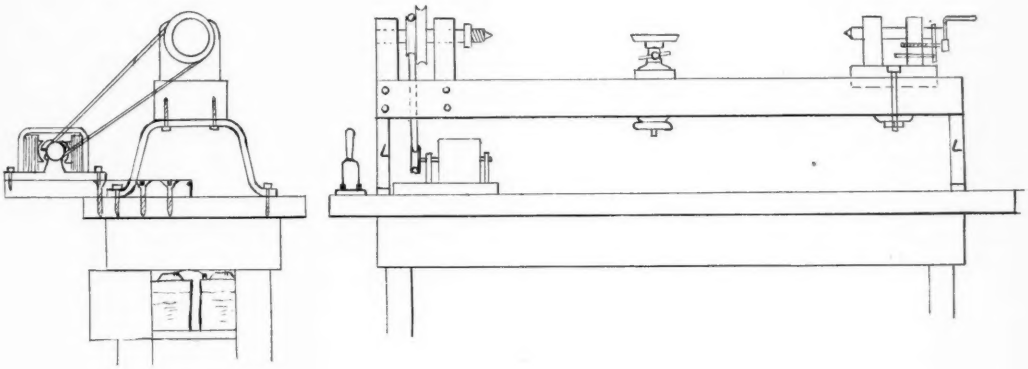
As this lathe is not intended for heavy work, the ways will be sufficiently rigid if made of 2″ x 3″ stock, 36″ long, though they may be longer if desired, the illustration showing them to scale as 48″ long. The pieces of the head stock hold one end rigid. The other end is spaced apart by a block of wood 2″ x 3″ x 3″ fastened flush with 6″ x $\frac{1}{2}$″ bolts, the heads being sunk into the front way as with the head stock.

If foot-power driving motion is desired, the directions given in AMATEUR WORK for May, 1902, can easily be modified to suit this design, but the reader is recommended to make a trial of electric power, which will be found very satisfactory for all but the heaviest kind of work and fully adequate for anything likely to be attempted on this lathe. An arrangement such as will be described is in daily use, and those using it prefer it greatly to anything previously tried.

Assuming that an electric motor is to be used the lathe should be supported upon iron legs, *L*, made of bar iron 1 $\frac{1}{2}$″ x $\frac{1}{2}$″ and 22″ long, bent to the shape shown and so as to bring the bottom of the ways 6″ above the supporting table. Holes are drilled through the ends for screws with which to attach to table or bench. If no spare place on a work bench is available, then a substantial wooden table should be made the top 56″ x 24″ being of 2″ plank, and the legs of 2 x 3 spruce 24″ long. Under the end, above which is the head stock, fit a strong well made box, to hold three or four cells of battery of the closed circuit type, a door on the end with button for holding, keeping out dust and shavings.

A piece of 2″ plank, 15″ long, and 8″ wide, is fastened to the table with screws in such a position that when the motor is attached thereto, the pulleys on the lathe and motor will be in line.

The motor having but one pulley, will necessitate two belts for different speeds, or a rheostat can be added to the circuit and any speed obtained with one belt. A baby knife blade switch is attached to the top of the table, under the head stock, allowing the circuit to be quickly opened or closed as desired. This is advisable as when no actual work is being done on the lathe the motor is shut off. It is started so easily and quickly that this will not be found objectionable, and when boring or drilling is very handy.



A good motor will be necessary; the armature must be heavy and have adequate "pull" or *torque*. Several firms dealing in motors and mentioned in the advertising columns will send circulars and prices upon request. If time permits one can be made up from castings at small expense.

Another driving motion, one really quite servicable, can be made from an old sewing machine stand, on which the threadle and fly wheel are still in good running order. Anyone living in a city with junk shops can get what is wanted from such places at about any time, or a search around the neighborhood may discover one to be had for the asking.

Bacillus fragi is the name given to a new microbe discovered by a chemist, M. Eichholtz. It possesses the property of imparting to the medium in which it thrives and multiplies a strong flavor of strawberries. M. Eichholtz first isolated and developed his bacillus in milk. The microbe was found to peptonise and render soluble the albuminoids contained in the milk. At the same time the liquid, which the chemist was courageous enough to taste, had a pronounced strawberry flavor. The bacillus fragi conveys, it was ascertained, its peculiar property to several other liquids and some solids, beef-tea being among the former. On mashed potatoes, however, it refused to produce any effect, although the vegetable is known to be as a rule a favorable medium for the development of bacilli. M. Eichholtz hopes for great practical results from his discovery

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Mr. Nikola Tesla, has taken out patents at Washington on a new wireless telegraph system. on which he has been at work for over a year, The principal feature of the system, according to Mr. Tesla, is the employment of two or more wave frequencies at the same time. By this mode, he says, when the receiver is attuned thereto, greater secrecy is secured than by any other system, and outside interference with the working of the instruments is made impossible. Mr. Tesla will shortly give a demonstration of his system.

White "black" berries will soon be common enough. The new variety has been grown by a well-known breeder of new fruits, Mr. Luther Burbank, of Santa Rosa, California. It is called the "Iceberg," and was crossed from the well-known Lawton blackberry. It is quite hardy, equal in size to the old sort, and prolific.

AMATEUR WORK

77 KILBY ST., BOSTON

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New advertisements, or changes, intended for a particular issue, should reach the office on or before the 15th of the previous month.

Entered at the Post-office, Boston, as second-class mail matter Jan. 14, 1902.

SEPTEMBER, 1903.

At the request of numerous readers of this magazine, the Special Premium offer announced in the February issue has been changed so that the First prize is a 10 Inch Screw Cutting Lathe, this seemingly being more desirable than a trip to the St. Louis Fair, which is withdrawn. Arrangements for four additional premiums are about completed, and will be announced in the next issue. As these special premiums are given in addition to the regular ones, as rewards for pertistent work, we are confident our readers will appreciate these liberal offers, and willingly help us in onr work of making this magazine widely known, and regularly read by thousands who would welcome it if brought to their attention. Subscription blanks, premium list and other reading matter of assistance to workers will be mailed upon request. Make an immediate beginning, and keep at it; as by thus working up prospective subscriptions, you will be more likely to win one of these valuable premiums.

We are again obliged to announce that premiums are not given to those sending in their own subscriptions, or for renewals. Also, that subscriptions received from persons in the same household as the sender, will not secure a premium. It might be well to start at this time, the object of premium offers. A new magazine, no matter how interesting its contents, is a long time in becoming known to those who would be regular readers of it, were they to learn of its publication. As an incentive to subscribers to devote some of their spare time to making the magazine known, and for securing new subscriptions, the premiums are given as a reward for this work. We are greatly pleased at the interest shown by so many, and desire to thank them for the assistance they have given in helping to bring in such a short time, the success which the magazine has attained. The liberal premium offers should not be overlooked by all readers, as new subscriptions are easily obtained, to the profit of the senders.

The chapter on "Shop Practice" is omitted from this number, but will be given in the next as usual.

Readers will note the increase of four pages to this number of the magazine, the increase in size being permanent, and necessitated by the large number of interesting articles which we are regularly receiving and are pleased to place before our readers.

The N rays recently discovered by M. Blondlot have been found capable of raising the luminosity of a glowing solid or gas without raising the temperature of the luminous substance. More light without more heat is something of a paradox. The *Electrician*, which reports the news, remarks that "there seems to be under the influence of the N rays some modification of the atomic vibrations, which, while leaving their energy the same, increases their frequency. In any case, the fact itself is of great interest and importance. Anything which tends to increase the luminosity of a body at the expense of its temperature brings us nearer the solution of the great problem of the economical production of light."

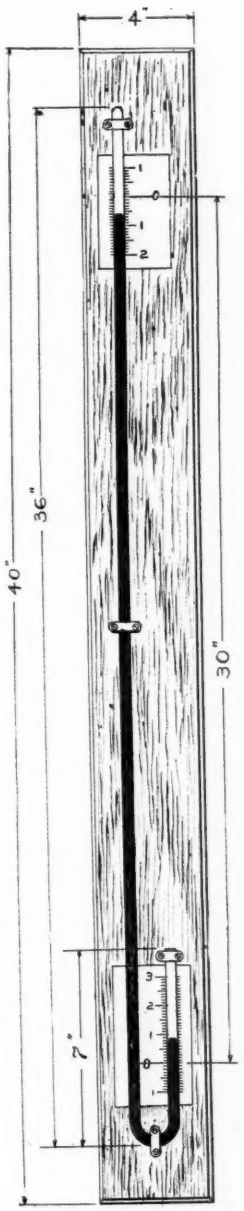
A MERCURIAL SIPHON BAROMETER.

Robert Gibson Griswold.

The direct reading barometer described in last month's issue was not self-calibrating, and it is necessary to calibrate it with some standard form of instrument, such as that herein described. In this form of instrument the column of mercury is balanced against the air pressure direct and the exact length of the column of mercury can be measured. Since barometric pressures are generally referred to in inches of mercury, or the length of the column of mercury in inches or millimeters, the actual pressures in pounds per square inch need not be known.

When completed, the two instruments are hung side by side, and any variation in the atmospheric pressure indicated by the siphon barometer is marked on the dial of the other. In this way a series of points corresponding to various heights of the standard column may be laid off, and the sector properly graduated so that its indications will be correct.

The glass tube *a* should be about $\frac{1}{4}''$, bore and bent as shown in the form of a J. To properly bend a glass so that it will be smooth and regular is an operation requiring some patience. Heat the portion to be bent in a flat gas flame, or what is generally known as a "fish tail" flame, until it feels soft between the points held in the hands. As a yellow flame is hardly hot enough to do this well, and as a bunsen burner adequate for this work may be had at little expense, the reader is advised to get one. If gas is not available, a blow torch may be used. In heating a glass tube take hold of it an inch or two on either side of the flame, and constantly rotate it between the thumb and forefinger while heating to insure that it will be heated evenly. When quite soft and showing a tendency to drop, remove from the flame and with a steady motion, bend into the J as shown. If not soft enough the tube may collapse on the outside of the bend, but by carefully reheating and blowing into one end, the other being closed with a small cork, the softened parts may be blown into fair shape.



In cooling be very cautious about placing it where a draught of air will strike the heated portion, as it will crack easily. A far better method is to wrap up the heated part in cotton wool and lay aside to cool, which will insure slow cooling and practically anneal it at the same time.

To close the end *b* use a small blow-pipe directing a blue flame directly on the end. As it softens it will be seen to gradually close and finally seal the tube completely. Wrap this end also in cotton wool to cool. It may be remarked that the tube should be thoroughly cleaned inside before bending at all. Pass a stout twine through it, and fasten thereto a small wad of cotton. Pour a little alcohol into the tube and draw the cotton plug through several times by means of the cord, which will clean it thoroughly.

Filling the tube with mercury is perhaps the most difficult operation in the whole construction. Owing to the shape of the tube it is impossible to pour it down one leg. The best method is to draw a small glass tube out to a long fine point by heating and pulling the ends apart while hot. Then bend the fine end slightly so as to form a small turn, and insert this end into the open end of the tube so that it reaches the bend. Make a small funnel of paper, and tie it securely to the small glass tube, having previously bent the tube at a right angle just outside the barometer tube so that the latter may be placed in an inclined position to allow the mercury to run to the closed end.

The mercury should first be cleaned, if not already so, by squeezing it through a chamois skin folded into the shape of a bag and securely tied. This will filter all dirt out of it.

Pour the cleaned mercury slowly into the funnel allowing it to run to the closed end. When the long leg is nearly filled, support the tube in the inclined position, and gradually heat the entire length with a Bunsen burner or an alcohol lamp to expel the air, and any moisture that should happen to be present. The mercury should be boiled in the tube, but as this is impracticable the heating will answer as well. Be sure that there is not a single air bubble, however small, left in the tube, as that will affect the reading of the instrument, rendering it inaccurate. Then fill the bend with mercury, and gradually bring the tube to a vertical position, when the mercury in the longer leg will fall a short distance rising in the shorter leg at the same time.

The space above the column of mercury in the longer leg is a vacuum and should be perfect; that is, should contain absolutely nothing. The fact is, however, that a small quantity of the vapor of mercury may be present, but this is generally so small that it will not materially affect the accuracy of the instrument. This space should be about three inches long, and may be adjusted by pouring mercury into the open end or taking some out with the small tube above spoken of.

Secure the tube to the base by means of small brass clips as shown, using small screws to fasten them, as nails may cause a break in the tube due to the hammering. The scales are to be drawn on white Bristol board, the main divisions being inches; these being divided into tenths, or even twentieths. When mounted on the board the zero divisions should be exactly 30 inches apart. One side of the scales may be divided into millimeters, which enables the readings to be taken with more accuracy, and which readings correspond with the scientific standard.

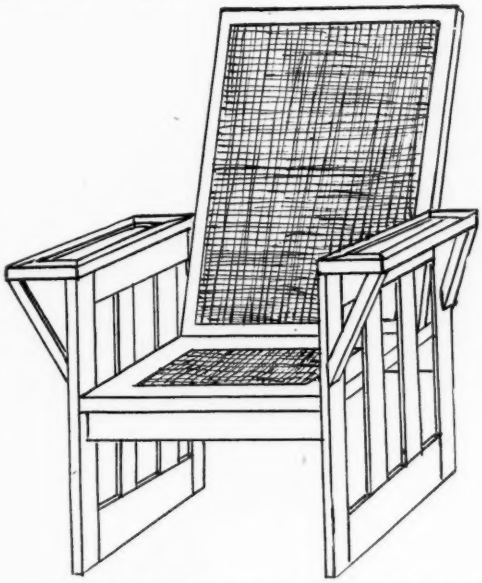
In reading this form of instrument, some little care must be used and a small calculation made. Read the distance that the top of the column of mercury in the longer leg stands below the zero line. To this add the distance between the zero line and the top of the column of mercury in the shorter leg. Substract this sum from 30 and it will give the true length of the barometric column in inches. The reading in millimeters is made in exactly the same manner, the zero lines being exactly 760 millimeters apart. The barometer tube should be so mounted that it stands in a perfectly vertical position.

The Deutsche Kolonial Zeitung reports the finding in North Nigeria of a plant (*Ocimumviride*) two or three of which, when placed in a room or on a veranda, will remove mosquitoes. The effect is produced by the odor exhaled. This resembles thymian and eucalyptus. The natives extract an essence from the plant that is an excellent substitute for quinine. It is not only equal in its effects, but it lacks many of quinine's disagreeable attributes. The Deutsche Ostafrika Zeitung reports that a great many natives are familiar with a mosquito plant, called by them "rumbasi," which has similar properties.

A LIBRARY CHAIR.

JOHN F. ADAMS.

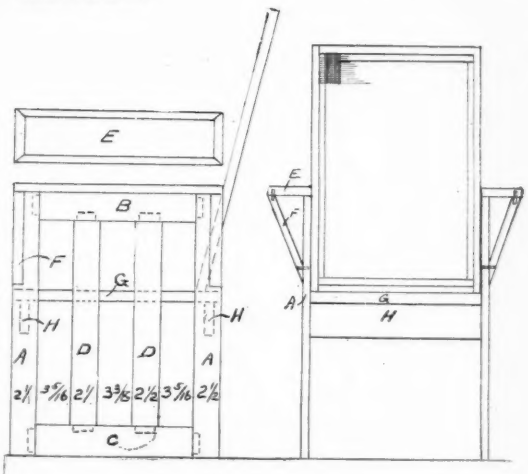
The design for the chair here presented, is an adaption from a chair designed and made by a cabinet-maker for his own home, the only changes being those advisable in the way of easier construction, without loss of strength. This chair can easily be made by anyone taking sufficient care to see that all the joints are well made and square.



The frames for the sides may be made first. Four pieces *A* are required, each 25″ long, 2″ wide, and 7-8″ thick. Mortises being cut as shown in Fig. 2, for tenons on the ends of pieces *B* and *C*. The two pieces *B* are 18″ long over all, 2 1-2″ wide, and 7-8″ thick, 1″ on each end being allowed for tenons. The tenons are 2″ long, and 3-8″ thick. The two pieces *C* are 18″ long, 3″ wide, and 7-8″ thick, allowing 1″ on each end for tenons. Mortises are also cut in *B* and *C* to receive tenons on the ends of pieces *D* which are 21 1-2″ long, 2 1-2″ wide, and 7-8″ thick, the tenons on the ends projecting 1″ and measuring 2″ x 3-8″.

The arms *E* are paneled, a frame being made with the inner edges rabbeted on the under side to receive the panel. The frame is made of strips 7-8″ square, those on the side being 20″ long, and and on the ends, 5″ long, the joints being mitred. The rabbet is cut 3-8″ x 5-8″ bringing the upper sides of the panels to 1-4″ from the top. The panels are 19″ long, 4″ wide, and 1-2″ to 5-8″ thick. Supports *F* are placed at each end at an angle. These are 7-8″ square and 10″ long, the ends being mitred to fit the arm and side, and fastened with 1-2″ dowels glued in.

The seat *G* may next be constructed. It is of the plain box seat kind, 20″ from front to rear and 18″ wide. The side pieces are 20″ long, 3″ wide and 7-8″ thick; the end pieces 15″ long and 3″ wide, allowing 1 1-2″ on each end for tenons to fit mortises cut in the side pieces. Or the ends may be 18″ long, the joints being made by halving, and held by glue and screws, but the former is preferable. A frame just fitting the inside of the seat is made of strips 3 8″ square, a piece of the leather carpeting or cane seating used for the seat and back, is then cut so that the edges will fit down over this frame, which is then put into the seat and fastened at frequent points with screws of small guage. The seat is supported by two pieces *H*, 19″ long, 3″ wide and 7-8″ thick; 1-2″ on each end being fitted to mortises cut on the inner sides of *A* of the sides, so located as to bring the top of the seat 16″ from the floor.



The seat is fastened to these supports by long screws put up through *H*. Holes are first bored to a depth of 2″ with a 1-2″ bit, and then continued through with a gimlet bit a trifle smaller than the guage of the screw. In addition, angle irons may be put on at joints between seat and the strips *D* of the frame, on the under side of seat, if it is found necessary to make all perfectly rigid.

The back is made up of two frames of square strips, with mitred corners, one frame just fitting inside the

other, and the material used for the back, being in place, the inner frame is fastened to the outer one with numerous round head screws. The outer frame is 28″ high and 17 3-4″ wide, if adjustable, or 18″ wide if rigid. The inner frame just fits this one with allowance for the covering material. If adjustable, the bottom of the back is attached to the seat with hinges put on in the same way that would be used, were the lower end of back the side of a door, and swinging backward. The brass cross rod and holders for same will have to be purchased of a dealer in furniture fittings, or perhaps a local furniture dealer will obtain a set from some manufacturer for you.

The covering most suitable for the seat and back is the closely woven cane covering, used in railway coaches, but, as this may not be easily obtainable by many readers, horse hide or pig skin leather or carpeting may be used as preferred.

A POWER DORY.

CARL H. CLARK.

II. SETTING UP THE FRAME.

Since the laying out of the several pieces affects the shape of the whole boat, it may be well to give some further details of this work. A large drawiug board or table will be found convenient for this purpose, or lacking this, a smooth floor can be used. A piece of board about 4′ long, with one edge planed straight, is used as a base or reference line, and to draw verticals, or lines at right angles to this, a carpenter's steel square is the most convenient tool.

It is to be noted that all dimensions are at right angles to each other. In laying out frames the paper should be tacked on the floor, one tack in each corner being sufficient, and the base board fastened along the lower edge. At some convenient point a vertical line for a centre line is drawn with the square. To locate any point for which the vertical and horizontal dimensions are given, lay off the horizontal dimensions along the base line; at the point thus obtained draw a vertical dimension from the base board along this vertical, marking a small circle or cross at the point. The same method is followed with the remaining points, and they are connected with straight lines or a continuous curve as the case may be. Before removing the base board, the pencil should be run along it to preserve the base line in case of an error being made or for reference. In laying out the angle for the stern knee the 2′ 1″ is laid out along the base line, a vertical is drawn, and the 2′ 6 1-2″ laid up on it; the point thus found being connected with the starting point. The diagonal dimension 3′ 3 1-2″ is useful as a check, but is not necessary. The stem, Fig. 6 is laid out in the same manner and the curve drawn in with a light batten.

It will be well at this point to bevel the edge of the bottom as shown in Fig. 5, and at *a* in Fig. 10, to the angle of the mould at these points. This angle can be obtained from the mould with the bevel, and the bevel cut on the bottom for a space of a few inches at each mould station since these are all different; the varying bevel between moulds can then be worked out by using the portions already cut as a guide. The bevel should only be cut approximately now, some stock being left to take off after setting up.

The next step is to set up the several parts already gotten out, and fasten them together. The remainder of the work should be done, if possible, in a place where there are beams overhead, or some similar means adopted, so that braces can be used to hold the work in place.

The stem is first fastened in place, the corner *a*, Fig. 6, being just at the forward end of the bottom, and the centre line of the stem agreeing with that of the

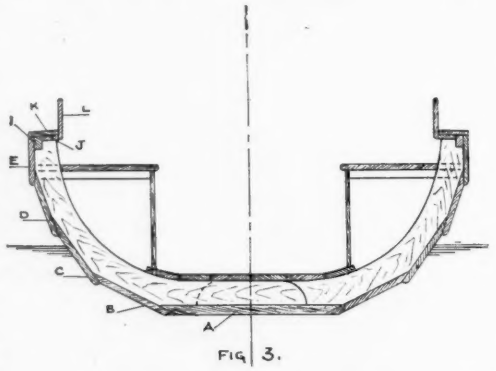


FIG. 3.

bottom. If the stem interferes with the forward cleat already fastened across the bottom, the cleat may be moved aft to clear the stem, or the latter may be cut out to fit over the cleat.

The stern board also is fastened temporarily in place. The whole is then set on a level floor, and a line stretched rather tightly between a nail in the top of the stem on the centre line, and one in the top of the stern board at the centre line. A short line with

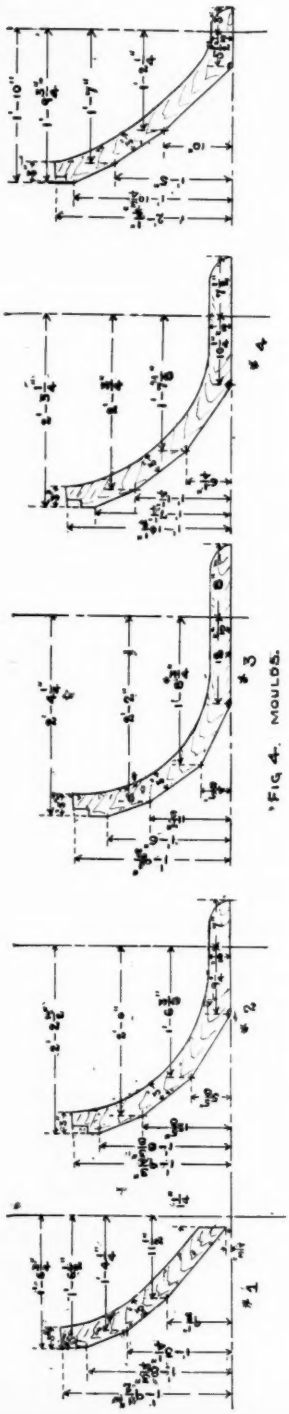


FIG 4. MOULDS.

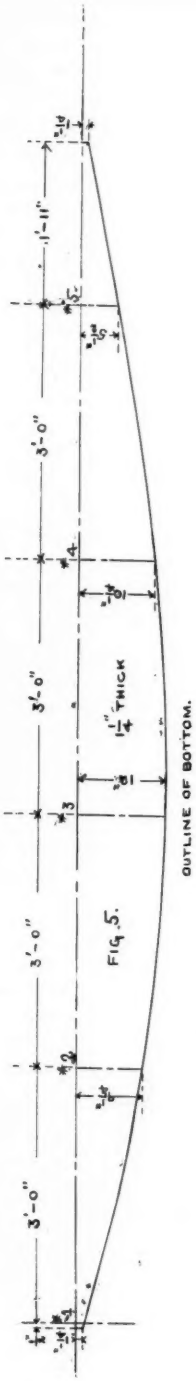


FIG 5.

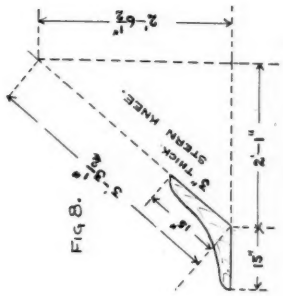


FIG 8.

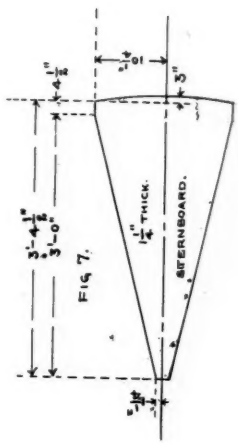


FIG 7.

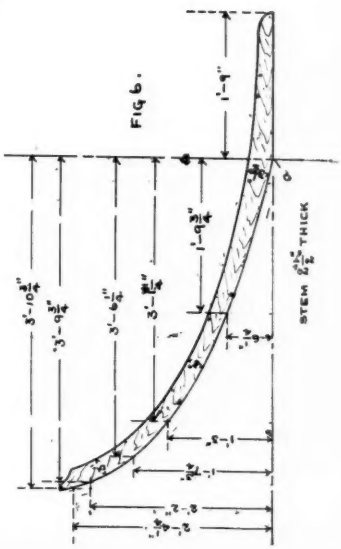
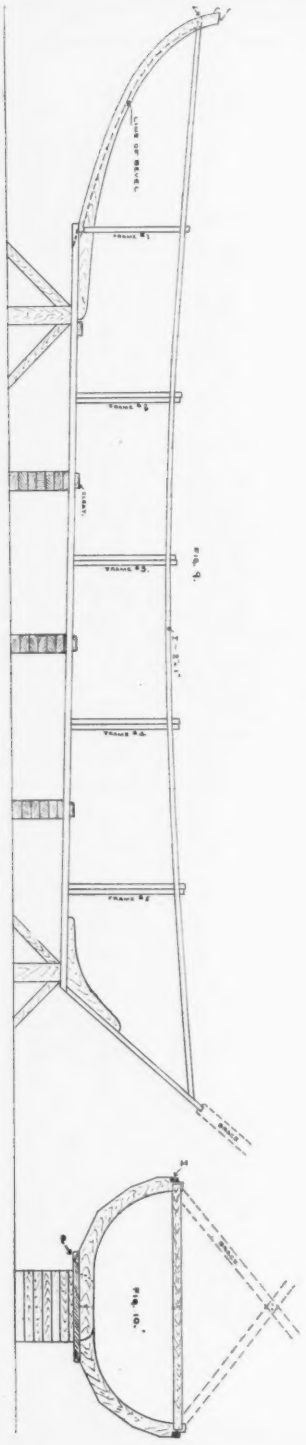


FIG 6.



plumb bob attached is then arranged to slide on the other, with the plumb bob just clearing the bottom board. Then, by adjusting the stem and stern board until the bob swings just over the centre line marked on the bottom, it can be made sure that the centre lines are all in the same plane. Care must also be taken to see that the stem points directly forward and that the stern board is square with a fore and aft line When they are adjusted they may be riveted in place with galvanized rivets about 3-8″ diameter, riveted over washers.

A hole is first bored 3-8″ diameter, which should be just a good driving fit. The rivets are from the outside a washer is slipped on and the rivet cut off about 1-8″ outside the washer. A heavy hammer, or other weight, is then held against the bead, and the inside end headed over the washer by hammering with a riveting hammer. It should be driven until the joint is brought up tight. Care must be taken to keep the rivets in the stern knee clear of the location of the shaft hole, which will be about 4″ above the corner. All surfaces must be painted with lead paint, before fastening together, and it may be well at this time, to paint the bottom and stern board all over, to prevent checking.

The bottom, with the stem and stern board in place is now to be set up in the place selected, as shown in Fig. 9. The supports are built up of blocks and planks, so that the bottom is about 15″ above the floor, for ease in fitting the planking, and with its forward end 4 1-2″ higher than the after end. The blocks had best be arranged to come between the sawn frames, and under the cleates already in place; they can be built up readily of sections of 2″ x 4″ spruce joists, laid flat and nailed one to another, the top layer being beveled off to fit the slant of the bottom. These blocks must have their upper surfaces all in the same plane, and to secure this, it is suggested that the forward and the after one be gotten out first; the latter 4″ lower than the former. They are fastened down, 12′ apart and braced fore and aft, and their upper surfaces beveled off until a line stretched across them lies evenly on the surface. The others are then gotten out and fitted until they come just to the line, and also are level when a carpenter's level is laid upon them, they are then fastened down by driving nails diagonally into the floor. It is essential that these blocks should be all even, and it will be well to test them by sighting along their upper surfaces; any irregularity in which should be corrected.

It is to be noted that these blocks are to be about 3″ narrower than the bottom at their respective positions, as shown in Fig. 10, to allow access to the edge of the bottom. On account of the narrowness of the bottom at the ends, the two end blocks can perhaps be better made of a 2″ x 4″ joist set on end and shored as in Fig. 9.

As soon as the bottom is gotten to lay evenly on the blocks it can be held in place temporarily by a piece of board at each end driven between it and the beams

above, these shores being kept to one side, clear of the line stretched from stem to stern board. This line can now be stretched, and the corrections of all the parts tested as before mentioned, any inaccuracies being corrected.

The moulds, or sawed frames are now to be set up in their proper places on the foundation. It is to be noted that they do not stand at right angles to the bottom, but are plumb, thus making a slight angle with the bottom. It will therefore be necessary to bevel the bottom of each pair of frames to the proper angle, which can be obtained by setting a bevel to the angle made by the bottom, and one of the supporting blocks; and planing the moulds to fit this angle. They must set squarely on the bottom, and can be tested by setting up and laying a bevel on the face of the mould, when its plumbness or otherwise will be shown in the short tube near the end of the level. The foot of the frame should be planed until the level shows it to be plumb when set upon the bottom.

The moulds are then set up on the bottom at the proper stations, with the joint between the two parts of the mould on the cross line of the bottom and the centre lines coinciding; also the centre line drawn on the cross piece of the mould must be just under the line stretched fore and aft. The forward mould No. 1 does not, of course come on the bottom, but on the stem, and should be adjusted so that its lower corner is about 1-2″ above the lower edge of the stem, and fastened lightly to it.

When the moulds are adjusted in all three ways, they can be nailed lightly to the bottom and a strip nailed, fore and aft along the tops of the centre pieces each side of the centre to hold them in place. The moulds are now fastened permanently to the bottom by brass screws driven from below, these are 3″ long and there are four in each frame except the after one, which has three. The heads are well countersunk, and they should be driven tightly. A little lead paint or soap smeared on the threads of the screw will be found to make it drive easier.

The setting up of the moulds is perhaps the most important work in the whole boat, as its fairness depends upon their accuracy so that it is worth spending the necessary amount of time to have them right.

A pair of strips *I* Fig. 3 are gotten out 2″ x 1″ and about 21′ long. They may be of spruce or any convenient stock, and should be planed smooth.

The fairness of the moulds as set up should be tested by using one of these strips, bending it around the moulds with one edge even with one corner of each mould; the line thus defined should be fair and smooth, and if it is not the reason should be found and the proper mould planed until corrected. Both sides must be carefully kept alike if any alteration is made.

Taking now the upper mark before made on the frames, another line is made 1 1-4″ below it and the strips bent around with their lower edge on the line just made and the ends carried in a fair line on to the tem and stern board; they can be held in place with clamps, or by nailing lightly. The line of the deck, thus defined, should be carefully tested for fairness, and may be adjusted at any point, by moving the strip a slight amount, being careful to keep both sides alike.

When this is satisfactory, a notch is cut as before mentioned and shown in Fig. 4, the right size to allow the strip to set in flush with the outside surface of the moulds. It is then set in place and fastened with long but rather slim galvanized nails, the ordinary wire nail galvanized, being preferred. It must be remembered that the tops of the moulds are later to be cut off 3-4″ below the top of strip *I* to admit *J*, so that in driving these nails they must be kept low enough to not interfere. At the ends, the strip *I* is cut to fit nicely inside of the stem and stern board. This stiffens the moulds and should hold them firmly in place Fig. 1 shows how it fits inside of stem and stern board but does not show the cleates mentioned as they will be removed later.

Diagonal braces as shown in Fig. 10 or some similar method one to be arranged, as in working the plank considerable pressure is brought to bear and it must not be allowed to force the frames out of line.

Braces to stem and stern as shown dotted in Fig. 9 are to be fitted to prevent end motion. The edges of all the parts have thus far been left square, and it is now necessary to bevel them off so that the plank will lie evenly on the face instead of across one corner as at present. This has to be done by trial, and a strip about like *I* will be useful as a guide; it is bent around as before described and the edges beveled until by trial it lies perfectly flat on the edge of every mould. The line defined by the corners should be finally tested for fairness and any remaining irregularity corrected. The stern board is beveled off at the same time, and also the stem; the latter is not carried to an edge on the forward face, but is left about 3-4″ wide; the bevel will probably not extend back to the inside face, but some of the original flat will remain.

The bevel on the stem is carried just to the upper edge of strip *I* as shown at *b* Fig. 9, and the upper end of the stem which projects above the deck is left square to make a joint with the outer stem or rubbing piece *G*.

The bevel of the bottom is to be 23 finished so as to exactly follow the angle of the lower flat of the mould, and should be planed smooth and fair so that the plank will lie on the frames and make a good joint on bottom and stem. It should not be left with a feather edge on the side, but should be about 1-8″ thick at the edge, as a thin edge will sblinter. Mould No. 1 may now be fastened firmly to the stem by a rather stout nail driven through it into the stern.

The boat is now ready for the plank, which will be the subject of the next number.

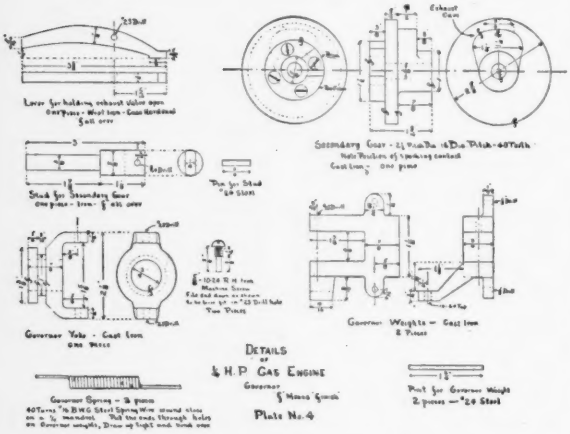
Send for our Premium List.

1=4 H. P. GAS ENGINE.

III. COVERNOR AND FLY WHEEL.

The large gear may be finished next. This gear has twice as many teeth as the small gear, that is 40 teeth of 16 diametral pitch.

Bore a 3-8″ hole through the centre of the casting and mount it upon a 3-8″ mandrel, turn it to 2 5-8″ diameter and face off the rim until it is about 5-16″ thick. The cam is cast on the side of the gear wheel and is to be filed up to the dimensions shown. On the plane face of the gear fasten the fibre block which

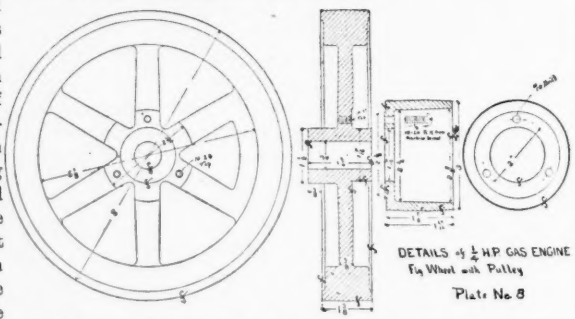


should be previously roughed out. This is attached by three flat head 8-32″ iron machine screws. It is sawed through and the small cast brass block inserted and fastened to the gear by an 8-32″ flat head iron machine screw. Then the outer surface is turned off to measure 1 1-2″ diameter and the side faced off until it measures 3-8″ in thickness. Care must be taken to locate the brass block in the right place. Referring to the cut, the exhaust cam will be shown dotted and the brass block in full lines. A fraction of an inch one way or the other will not matter as the brass contact spring may be cut to suit. The total length from outside of fibre to the opposite end of the hub is to be 1 9-16″. You can have the teeth in the gear cut at the same time you have the teeth cut in the small gear. The large gear is supported on a stud which is turned up from a piece of 5-8″ cold rolled iron. Take a piece of 5-8″ iron 3″ long and turn one end down to 3-8″ for a distance of 1 7-8″. In the larger end saw a slot 1-4″ wide to a depth of 1-2″. At 3-16″ from the edge drill a hole with No. 24 drill both sides as shown. The governor lever works in this slot and pivots on the pin which is driven through the No. 24 hole.

The governor lever is made of a piece of 1-4″ x 1-2″ flat iron bent as shown and the 5-16″ end case hardened. The other end is filed down to 3-16″ to fit in the groove in the governor yoke. The dimensions of the lever are not exact and the lever may have to be bent a little one way or the other when the engine is assembled. The hole is to be drilled with a No. 23 drill 15-16″ from the small end.

The governor yoke is to be bored out and reamed to 3-4″. Mount it on a mandrel and turn down to 1-38″ diameter. Turn a groove 3-16″ wide, and 3-16″ deep at a distance of 1-4″ from the side as shown. Drill the two arms with a No. 23 drill 3-8″ from the inner face of the casting. The two governor weights are to be drilled next. The long bent arms (one on each) are to be drilled and tapped for a 10-24″ machine screw. The screw is to have the end filed down so that when screwed into the arm the small end will fit in the hole in the arm of the governor yoke. The main body of the weight is to be drilled with a No. 25 drill for the pin which attaches it to the fly wheel.

We are now ready to finish the fly wheels, and will proceed with them next. Hold the fly wheel in the chuck and bore out and ream to 3-4″. Mount it on a 3-4″ mandrel and turn to 8″ outside diameter. When doing this, crown the surface slightly so that it will be the largest diameter in the centre of the face and slightly smaller at each edge. Face the sides off until the fly wheel measures 1 3-8″ across.

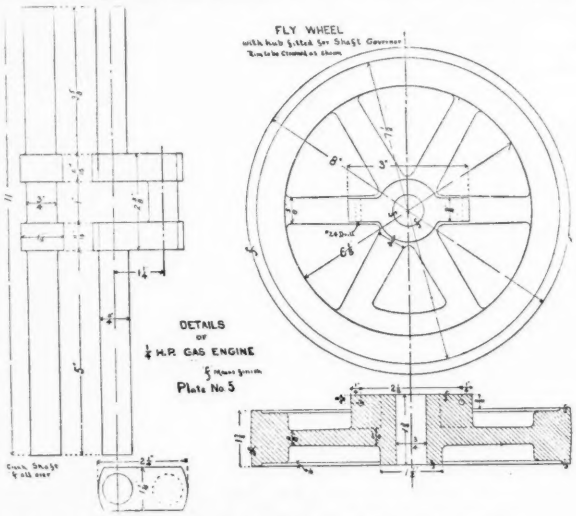


So far both of the fly wheels are exactly alike. In finishing the governor fly wheel the mandrel is to be left in the wheel and the governor yoke slipped on with arms towards the wheel on the "Long Hub" side. The governor weights are to be placed in position straddling the spokes of the wheel and are to have their arms attached to the arms of the governor yoke. When in position drill the holes in the lugs on the fly wheel, the holes in the weights acting as a

guide. You can now pin the weights in position. They ought to move easily so that pushing the governor yoke towards or away from the fly wheel will move the weights in or out. The proper position for the various parts may easily be understood by a reference to the various illustrations.

The governor springs consist of ten turns each of No. 16 B. W. G. spring steel wire wound close on a 1-4″ mandrel. Put the ends through the 1-8″ holes in the lugs on the governor weights, draw up tight and bend over.

The next operation is to finish the fly wheel with pulley. As the work on both is practically the same we will suppose that you have bored and faced the



pulley fly wheel. Turn down the hub on the short side to 1 7-16″ diameter and take a light cut off of the spokes to a diameter of 2 1-2″. This is to make a smooth surface to bolt the pulley to. Hold the pulley in the chuck and bore out to 1 7-16″ to slip over the hub on fly wheel. Face off the flat surface and turn a shoulder so that you have a surface 2 3 8″ diameter as shown. Fasten the pulley to the fly wheel by means of three 10-24″ round head iron screws and then turn it off to 3″ diameter, slightly crowning it to make the belt run in the centre.

You have now come to the most difficult part of the work; the turning of the shaft. To do this make two pieces of iron about 1 1-2″ thick x 1 1-2″ wide, x 3″ long, and at one end drill and ream a 3-5″ hole clear through. Lay off at a distance of 1 1-4″ a deep centre in each piece and drill and tap for a set screw substantially as shown in figure *A*. The object of these pieces is to enable you to find the crank shaft when turning the crank pin or wrist pin. You are now ready to turn the shaft. First turn the shaft on centres until it is a snug and close fit in the fly wheels, then slip on the two centering blocks and set screw them to the shaft so that the wrist pin runs approximately true. You will now be able to turn the wrist pin to the exact size; at the same setting facing off the sides of the crank arms until the space between them measures 1″. The thickness of the arms themselves measured lengthwise of the shaft is to be 11-16″. Be careful not to turn the shaft and wrist up to a square shoulder but leave a small fillet where they join the crank arms.

CULTIVATION OF CAOUTCHOUC IN KAMERUN.

According to the Deutsche Kolonial Zeitung, the rubber trees, or plants, discovered by Dr. Paul Preuss on the right bank of the Mongo in the primeval forests of Malende, in Africa, are being set out for the purpose of securing a large supply of rubber. Investigation by experts revealed the fact that Preuss's wild rubber trees, of which he found hundreds marked with tin slips so as to keep a correct account of their years, conditions, etc. It has been satisfactorily demonstrated that the "tapping" of the trees has done nothing to delay or to diminish their growth. The success of Soppo has aroused enthusiasm all over Victoria. The colonists are all turning their attention to the cultivation of *Kickxia*. They are buying seedsin Soppo and sowing them wherever success seemsassured. They have taken to the Kamerun plant the more readily because Professor Preuss's experiments with *Kickxia* in the botanical gardens resulted in evidence which shows that *Kickxia*, in regard to rapidity of growth, early tapping, and size of the crop, is superior to all other caoutchouc plants, even the famous ones of South America. Recent reports tell of the finding of thousands of *Kickxia* trees in various parts of the colonies near Malende, particularly among the forests owned by the Koke Plantation Company and upon the 6,000 hectares (14,826 acres) of the Meanja plantation. Both sides of the Mpowo, which runs between the above named plantations are coveredwith a thick growth.

An article in the *Frankfurter Zuitung* states that, commencing on January 1, 1904, the price of electric light in Berlin will be reduced 27 per cent, from 55pfennings to 40 pfennings (13.1 cents to 9.5 cents) per kilowatt hour; and the price for electric light in Berlin will then be cheaper than in any other large city. This reduction was made to compete with gaslight, says; *Richard Guenther, U. S. Consul-General, Frankfort.*

1=4 H. P. HORIZONTAL ENGINE.

B. R. Wicks.

The last part of the machine work will be the valve stem, No. 378, and the eccentric rod, No. 379, with the exception of a liner to line up the cylinder, cross head guide and cylinder bracket square with the main bearings. The valve steam, No. 378, is turned between centres from 3-8″ x 7-16″ square, cold drawn steel, and finished up to the figures given in detail drawing. The slot for the eccentric rod is milled in the lathe tool post about the same way as the cross head. There is a thread cut on one end 3 1-16″ long, 30 threads to the inch; this thread as in other cases should be cut with a die stock with a guide. There are four 3-16″ nuts, 1-8″ thick, that hold the valve in position on the valve stem. These act as lock nuts, and must be a good fit, so that when the engine is in motion they will not work loose.

The eccentric rod, No. 379, is made from 3-8″ x 1-4″ cold drawn steel, and bent 9-16″ from its centre to the centre of the eccentric strap, and a thread cut 9-16″ long to fit in the boss in the eccentric strap. The valve stem and eccentric strap are held together in the joint by 3-16″ x 5-8″ fillister head screws with a 3-16″ lock nut on the outside.

This finishes all the machine work, the drilling and tapping for the screws which hold the cylinder bracket and main bearings to the bed. As this part of the assembling has to be done with the greatest of care, a liner to do this work in the way it ought to must be made. Have at hand a piece of steel or cast iron about 12″ long, and 1 7-8″ diameter from which to make the liner. Centre the material and between centres turn up to 1 1-2″ to a distance of 2 1-2″, the length of the cylinder, and make it a good fit in the base of the cylinder without any shake. Increase the diameter from 1 1-2″ to 1 3-4″ for a distance of 3-32″, this being the width of the front cylinder cover. Turn around, end for end, in the lathe, and turn down to 9-16″ diameter to within 4 31-32″ of the 1 1-2″ end, and make the 9-16″ diameter exact and perfectly straight and smooth. Now turn to 1 1-4″ diameter to fit the cross head guide perfectly to a distance of 3 3-8″.

You will have the liner thus:— 1 1-2″ diameter, 2 1-2″ long; shoulder, 1 3-4″ diameter, 3-32″ wide; 1 1-4″ diameter, 3 3-8″ long, and the remainder, 9-16″ diameter. With a V pointed tool make the centres round the line, as per the assembling drawing; 2 3-4″ from the centre of the cylinder to centre of the cross head shoe stud; 5 27-32″ from the centre of the cross head shoe stud pin to the centre of the main bearings, and take the greatest pains to make these distances absolutely accurate.

Premiums are not given to persons sending in their own subscriptions.

NEW IRON-HARDENING PROCESS.

Phosphorus, as is well known, has the property of imparting a certain degree of surface hardening to iron, but not without producing brittleness. The iron is made to assume a coarse structure, in which the crystals are comparatively loosely bound together. This effect of phosphorus, of loosening the coherence of the molecules of the iron, greatly facilitates the absorption of carbon by the iron. The carbon rapidly penetrates the iron to a considerable depth, imparting great toughness to the core, and nullifying the comparatively slight defect constituted by the inconsiderable brittleness of the surface. Two Prussian inventors apply this principle in their process for hardening iron by heating the same in a tempering powder consisting of organic nitrogenous substances containing a high percentage of fusible ash, and employing phosphorus as the medium for the introduction of carbon into the iron. Without prejudicially affecting the welding properties of the iron, it imparts such a degree of hardness thereto, that it can neither be cut nor chipped by the best steel used. In order to harden the surface of about 200 kilograms (441 pounds) of iron to a depth of 1 millimeter (0.0394 inch) by means of this process, the pieces should be embedded in a retort, muffle, or the like, in bone dust, to which is added a mixture of 300 grains of yellow prussiate, 250 grains of cyanide of potassium, and 400 grains of phosphorus. The receptable is well closed, luted with clay, etc., and raised to a clear red or white heat, whereupon the material treated is immersed in a glowing condition in a water or other bath. *J. D. Hughes, U. S. Consul-General, Coburg.*

A very simple process has just been conceived by a Mr. Maestracci for making petroleum briquetts, very much resembling those made of coal. The modus operandi is as follows: To a liter of petroleum are added 150 grams of soft soap, 150 grams of resin, and 300 grams of caustic-soda lye wash. This mixture is heated and well shaken. As soon as the mass begins to solidify, which should be in about forty minutes, the progress of the operation should be very carefully watched. To prevent the mixture running over, a little soda should be poured into the vessel, shaking the whole until solidification is complete. When the operation is finished the matter is run into molds to be made into briquettes, which are then placed in a stove for ten or fifteen minutes. It then only remains to allow them to get cold, when they can be used within an hour or two of being manufactured. By the addition of sawdust and sand the briquettes will be more solid and at the same time cheaper. From experiments, said to have been conducted on tugs, the inventor claims it has been clearly shown that these briquetts give three times more heat than ordinary coal, there being, in addition, the advantage of no waste remaining.—*Oliver J. D. Hughes, Consul-General, Coburg.*

JUNIOR DEPARTMENT

For the Instruction and Information of Younger Readers.

SIMPLE ELECTRIC MACHINE.

ROBERT H. MCLEOD.

This simple electric machine can be made at but little expense, and will prove a source of much pleasure to the maker, and instructive amusement to friends who may see it operated.

The glass plate *g*, Fig. 1 will probably be the most difficult part to make. It should be, preferably, of crystal plate about 1-8″ thick but, smooth window glass may be used. A piece large enough to cut a

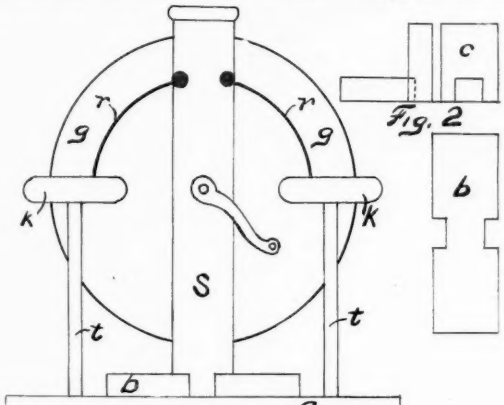
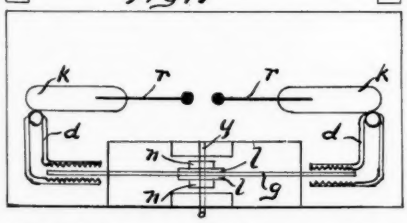


Fig. 1

Fig. 2



circle 12″ diameter is needed. Any glass cutter will cut it for you, if you have no means of doing it yourself. The directions for cutting and boring the hole are given in the June, 1903, number of AMATEUR WORK, so will not be repeated here. In the centre a 1-4″ hole is drilled, and the edges are smoothed by holding it vertically against a grind stone. or it may be filed, wetting the file in turpentine.

The base *a*, Fig. 1 is of oak, 15 1-2″ x 7 1-2″ x 7-8″, strips 1″ square being screwed to the under side of each end to prevent warping. The base *b* Figs. 1 and 2, for the standards is 7 1-2″ x 2 1-2″ x 7-8, also of oak. Sockets are cut in the centre of each edge for the feet of the standards. The two standards *s* Fig. 1, are of oak 14 1-2″ x 2 1-4″ x 1-2″, including the projection fitting into the base *b*. Make a good, firm fit between standards and base, fastening with 1″ wood screws, the heads countersunk. Across the tops of standards screw on a piece 3″ x 3″ x 1-2″. A 1-4″ hole is bored in the front standard and a 3-16″ hole in the back, 6 1-2″ from the top end to receive the shaft. When this frame is complete, screw it to the base *a* with several screws put through from the under side of *a*.

Four cushion blocks *c*, Fig. 2 are next made, 2 1-4″ x 3″ x 3-8″. A slot is cut with a saw 1-8″ from the face all around the edges, 1-4″ deep. On one edge of the face, opposite that nearest the saw cuts, make a socket 7-8″ square and 1-8″ deep. Four blocks 2 1-4″ x 3″ x 7-8″ with projections cut on the ends with the grain, and fitting the sockets in the cushion blocks, are then nailed to the latter to hold them upright. The faces of the cushion blocks are then covered as follows: over a layer of cotton batting put a covering of silk large enough to go over the edges, and be pressed into the saw cuts, fastening with strong twine. Trim off any projecting edges of the silk. Cover the silk with a layer of tin foil, allowing the latter to lap over the backs of the cushion blocks, and fastening with paste.

The shaft *y* Fig. 1. is a round iron rod 3 1-2″ x 1-4″. One end is threaded for about 1-2″ and the other end for 1 1-2″. This you can have done at any machine shop at small cost, obtaining two nuts *n* to fit the threads at the same time. The end with the longer thread is then smoothed off for 3-4″ with a file, to remove the threads and give a smooth bearing, leaving the diameter about 3-16″ on that end. Also obtain two 1″ flat iron washers *l*, and some thick felt or leather for washers between the iron washers and glass plate to prevent breaking the plate when the parts are assembled as shown in Fig. 1. The crank can be made from a piece of flat iron rod 4″ x 1-2″ x 3-16″, a hole at one end being tapped to fit the threads on shaft, or instead of threading that end of the shaft a 1-8″ hole can be drilled in it and a piece of 1-8″ rod bent to form a crank can be fitted in the hole. Over the shaft, and between the nuts and the standards, pieces of brass tube or round hard wood are put long enough to take up the end play, so the plate will revolve in one position.

In the base *a* bore 1-2″ holes 5″ from each end and 3″ from the back edge to receive the glass rods, *t* Fig. 1, which are 8 1-2″ long. The accumulators *k*, Fig. 1, are of round wood 4″ long, and 1″ diameter.

The ends are smoothly rounded, and the whole then covered with a layer of tin foil attached with paste, all creases being carefully smoothed so as to remove any projecting points through which electricity may be dissipated. Bore 1-2″ holes in the centre to fit the glass rods, and on the opposite side, bore 1-8″ holes to receive 1-8″ brass rods *r* about 10″ long. These rods are curved to the shape shown in Fig. 1, and on the outer ends are soldered smooth round, brass balls 1-2″ diameter. Buttons or bed-stead balls may be used, care being taken to carefully smooth off all soldering around the joint. It would be best, if the maker is inexperienced in soldering to have this work done by a jeweller.

The two collectors are made of 1-8″ brass wire about 14″ long bent to the shape shown at *d* Fig. 1. Before bending, put the wire through for each, through 1-2″ brass balls having 1-8″ holes through the centre. Then bend with a smooth curve. About 4″ of the ends are then filed flat to thickness af 1-16″, then teeth are filed on the inner edges with a three square or knife blade file. The bends should be located so that the teeth will be very near but not touch the revolving plate. The collectors are attached to the sides of the accumulators by small L shaped pieces of 1-8″ brass wire. the vertical ends fitting holes drilled in the bottom of the brass balls, and the other ends in holes bored in the side of the accumulators to give a tight fit.

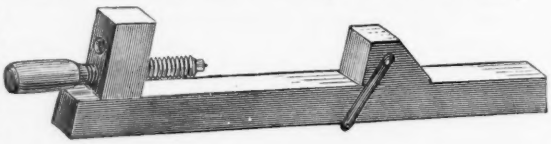
A simple way, but not quite as good, is to omit the brass ball, bore two holes in side of accumulator, have the combs in two pieces driven into the holes with a tight fit.

The machine is then assembled, the cushions being placed in pairs rubbing firmly against the plate and resting on the base. When the plate is revolved, the friction of the cushions generates electricity which is collected by the combs, conveyed to the accumulator and discharged between the two balls on the discharge rods. The distance between these balls, should be small at first, gradually increasing until the full distance is reached. Use a glass rod or rubber gloves for adjusting, after the machine is excited, unless you want to get a smart shock.

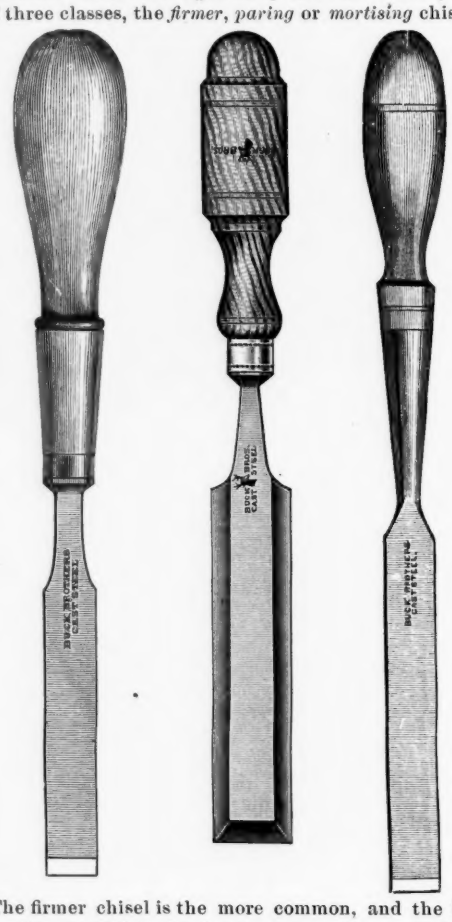
TOOLS AND THEIR USES.

CLAMPS. The wood worker who attempts other than the most simple work, will have occasion to use clamps for jointing boards, door frames, etc. Suitable clamps, which are quickly adjustable to quite a range of capacity, can be purchased at most hardware stores, and are not so expensive but that they are well worth their cost if any considerable amount of work is to be done.

When only an occasional job requires clamps, they can be made by screwing to each end of boards of suitable length, blocks of wood and wedging the work with wooden wedges. The blocks must be firmly attached, as the pressure of the clamps is heavy. Pieces of waste wood should always be put between the work and the clamps to avoid defacing the work. When the work is of any considerable size it is customary to use three or more clamps, one or more being put on the opposite side of the work from the others. This prevents the work from lifting at the joint. It is also desirable to have the work lay on level surfaces, while the clamps are on, to get a true surface. The tightening of the clamps will sometimes spring work out of true, in which case some adjusting will be necessary to get it in true. Joints set up with glue under pressure of clamps are usually much stronger than when clamps are not used.



CHISELS. Those more generally used are usually one of three classes, the *firmer*, *paring* or *mortising* chisels.



The firmer chisel is the more common, and the kind used in the lighter kinds of wood working. It differs

from the paring chisels only in length, the latter being the longer. The *socket* firmer chisel is adapted to a wider range of work than those with a tang driven into the handle, as when hit with a mallet, the handle of the socket chisel is less liable to split.

Beveled edge chisels are preferred by some, as it is claimed such chisels keep the direction better than those without bevels, but as beveled chisels are more expensive than the others, the ordinary kind will undoubtedly serve the needs of most readers of this magazine. The mortising or framing chisel is extra heavy, the better to withstand constant use with the mallet in getting out frame work for houses, etc.

A good assortment for amateur use, and adequate to the needs of quite a wide variety of work, is a set of six, including the following sizes, 1-8, 1-4, 3-8, 1-2, 3-4, and 1″. Additional sizes for large work would be 1 1-2 and 2″.

CHEAP ELECTRIC LIGHT FOR BERLIN.

German papers report the discovery by Mr. Edward Mollard, a Frenchman, of a new metal called "selium." According to the *English Mechanic*, the discoverer claims that selium costs but one-twelfth as much as aluminun and is lighter and stronger. It does not rust, and is therefore suitable for use in shipbuilding, for the manufacture of pipes, and for railroad construction. On account of its cheapness, and as it is capable of a fine polish, resembling nickle, it would be desirable for manufacturing cooking utensils. Its density is 2.6 and its hardness not quite that of iron, but greater than lead or zinc. Its power of resistance is said to be greater than that of iron, but less than that of steel. The melting point is at 1,600° C. In melting, it contracts somewhat, but molding in forms is not impossible. It will be well, however, to await more definite information concerning its properties.

IMITATION SILK FROM WOOD.

I have today seen samples of imitation silk for weaving purposes manufactured from wood. It is an English patent granted to C. H. Stearn, 47 Victoria Street, Westminister, London. My informant says that the plant is at present turning out 50 lbs. of skein silk per day, which can be increased to a daily output of 2,000 lbs. The sample shown me was very soft and of a cream color. Each thread is made of 18 single strands. A single strand is hardly perceptible to the naked eye. As to the relative strength of a real silk thread and this imitation, the real silk is two-thirds stronger. It is said to take coloring or dyeing readily, and when woven into pieces has the appearance of real silk. How this new artificial article compares with the genuine, in the way of wear and price, I am unable to say. No particular kind of wood is required. The pulp undergoes a chemical process, and is pressed through very fine tubes by hydraulic pressure, forming the single strands which go to make up the thread.

John E. Kehl, U. S. Consul at Settin, Germany.

CORRESPONDENCE.

OUR readers are invited to contribute to this department, but no responsibility is assumed for the opinions expressed in these communications.

Letters for this department should be addressed to editor of AMATEUR WORK, 63 Kilby Street, Boston.

They should be plainly written on only one side of the paper, with a top margin of one inch and side margins of one-half inch.

The name and address of the writer must be given, but will not be used, if so requested.

Enclose stamps, if direct answer is desired.

In referring to other letters, give the number of the letter referred to, and the date published.

Illustrate the subject when possible by a drawing or photograph with dimensions.

Readers who desire to purchase articles not advertised in our columns will be furnished the addresses of dealers or manufacturers, if stamp is enclosed with request.

No. 57. NEW YORK CITY, May 1, 1903

I have been experimenting with several rubber cement formulas with the view of finding some cement that will actually hold rubber patches and soles on rubber boots and shoes. Such as I have tried do not withstand rough usage, such as firemen subject their rubber goods to, and I should be pleased to receive assistance through your columns.

J. E. L.

You might receive some information by writing to manufacturers of rubber goods. If any of our readers have had experience in this line we shall be glad to hear from them.

No. 58. CRESTON, IOWA, May 18, 1903.

Will you kindly advise me what success you have had with the kerosene burner described in the November, 1902 issue of AMATEUR WORK? I have experimented with several different makes during the past two years and find that they all roar badly while in operation. How much oil will it consume per hour?

J. B.

The burner mentioned will give good satisfaction if properly adjusted and the reservoir supported at such a height above the burner as to give some force to the issuing stream of gas. The success of this type of burner depends upon the thorough vaporization of the oil, and the proper mixture of this oil with the necessary amount of air to render the flame blue. The amount of oil consumed depends largely upon the height of the flame, and varies between such wide limits that it is difficult to state the exact amount.

No. 59. GREENSBURG, PA., May, 29, 1903.

I wish to make an induction coil and would like to know if there is any difference between a jump-spark coil, a coil for wireless telegraphy and a Rhumkorff induction coil. Will you please let me know the difference, if any, as I should like to try a number of experimnets in these lines.

J. T. M.

There is no difference between the coils with regard to principal of action as each is an induction coil. Some little difference in the external mechanical work may exist to adapt them to the particular purpose intended, but each has a primary and secondary coil. The vibrator may or may not be directly attached to the coil itself, as in the original Rhumkorff, but this does not alter the construction of the coil proper.

No. 60. TRESSBANK, MASS. June 19, 1903.

What is the best material for an enlarging camera bellows, not too expensive? What power would be required to generate sufficient electricity to raise a 1-4 inch iron bar to a welding heat

in two minutes? Can you publish in AMATEUR WORK, drawings and specifications for a "Grandfathers" wooden clock movement? Could you not establish a sale and exchange column in AMATEUR WORK?

H. G. C.

Split leather is undoubtedly the best material, but very good bellows may be made by glueing up one layer of black "book-binders" cloth and two layers of block chintz. Before the mass is dry, bend into shape and when dry it will remain sharply folded.

It is a difficult matter to give an exact answer to this question but the time required is seldom over a few seconds. The power required will vary from 10 to 20 horse-power. Your time 2 minutes is rather long as the heat would have time to dissipate throughout the mass of the iron and not concentrate itself at the weld.

The clock movement appears in this issue.

We would be pleased to open a "Sale and Exchanged" column for subscripers, and will insert such notices at the rate for Classified Advertisements, 12 1-2 cents per line, minimum amount 25 cents, payable in advance.

No. 61. SHILOH, N. C. AUG. 10, 1903.

Will you please give me through your correspondence column answers to the following questions:—1. What should be the diameter of a rod when the safe working stress is 7, 000 pounds per square inch and the load is 5,500 pounds? 2. What should be the diameter and length of a steel end journal to support a load of 2, 300 pounds, assuming the safe working stress to be 8,500 pounds and $\frac{\text{Length}}{\text{Diameter}} = 1.75$

The rod should be 1 inch in diameter.

For the valves given in your question the diameter should be 1 553 inches.

TRADE NOTES

B. R. Wicks, Bridgeport, Conn., announces several improvements in the 1-4 H. P. Steam engines, made by him, and for which he also furnishes castings; which greatly add to their efficiency and attractiveness.

The design, workmanship and materials, the tools manufactured by the Smith & Hemenway Co. and Utical Drop Forge and Tool Co. 296 Broadway, New York City, are highly unsurpassed. Among those of special interest to readers of this magazine are the Seavey and Schatz mitre boxes, (every wood-worker should have one), cutting plyers, glass cutters, putty and wood carvers knives and trimers snips. The Acme ball bearing castors, are just the thing for furniture, the heaviest pieces fitted with these castors being easily moved.

The high quality of workmanship, materials and finish, which professional mechanics have long ago learned to associate with the tools made by the Morse Twist Drill and Machine Co., New Bedford, Mass, has a significance which should not be lost to the amateur or apprentice. A purchase of tools of this make is always satisfied. Their drills are favorably known the world over. Ask for them when you purchase.

An attractive advertising novelty in the form of a scratch-pad for matches, to be hung on the wall, is being put out by the Simonds Mfg. Co. Fitchburg, Mass. A hand saw is represented in outline with emery cloth, and the merits of this brand of saws are duly set forth.

The quick acting vises manufactured by Wyman & Gordon, 30 Bradley St, Worcester, Mass. are well known to both professional and amateur wood-workers, being in general use in many of the largest manufacturies, technical colleges, and manual training schools throughout the country. The simple yet quick action, large jaws, strength of grip, and good workmanship, make them unexcelled, and a most desirable tool for wood-workers.

The Frase Co., 38 Cortlandt St. New York City, make a specialty of bargains in machinery and supplies for mechanics. In a recently issued list are noted a band-saw, steam and gas engines several lathes of different sizes, drill presses, bench drills, etc. Anyone fitting up a shop should write for prices on tools required.

Not only the lumber, but also the prices for same, obtained of Clark & Smith, lumber dealers, 231 Medford St. Charlestown district, Boston, will be found quite satisfactory. Anyone proposing to build a power dory should consult this firm.

The Toppan Boat Mfg. Co., 9 Haverhill St. Boston, are the agents for several different engines suitable for the 20 foot dory now being described in this magazine. In addition, being builders of all kinds of launches, dories. etc., they can supply frames and other parts for those who are about to build. Correspondence is invited from those interested in building their own boats, or wishing to purchase one complete, with or without power.

The Mianus Motors are widely and favorably known to users of power lanuches, dories, etc. Built by experience mechanics of the best materials, simple in design, and of adequate power, purchases of these motors will find them entirely satisfactory.

All kinds of boat fittings, for the power dory as well as sailing boats, can be obtained of Bliss Bros. 170 Commercial St. Boston.

The monthly bulletin of new books issued by Spon & Chamberlain, 125 Liberty St. New York City, is mailed to anyone requesting it.

The electrical equipment for the Model electrical railway can be obtained of the Manhattan Electrical Supply Co., 32 Cortlandt St. New York City. Their new catalogue quoting net prices is mailed free upon request.

The Bureau Rueter states that the firm Holt, of Liverpool, which does a large trade with West and Southwest Africa, recently received a species of plant, hitherto unknown, that produces rubber. It was found in the French Kongo territory. The plant grows under ground. Mr. Holt is of the opinion that it will probably be found in English West Africa. If the bark of the plant is broken, the rubber keeps the pieces together and is of extraordinary elasticity. The rubber is directly beneath the bark and of unsurpassed quality. The sender of the specimen thinks it is *Landolphia tholloni*, or *Clitandra gracilis*. Ordinarily, the roots when about one month old contain from 6 to 6 1-2 per cent of rubber; if the bark is removed the percentage is from 12 to 15. The sample has been sent to Nigeria, for the purpose of ascertaining whether it grows there also.

Wireless telegraphy will play an important part in the naval war game this summer off the coast of Maine, and also in the joint army and navy manoeuvres, which will follow the completion of the search problem. Rear Admiral B. Bradford, Chief of the Bureau of Equipment, has ordered 20 sets of the Slaby-Arco system from Berlin, with the direction that they be rushed here in time for installation upon the flagships and scouts of the defence and hostile squadrons. The Slaby-Arco system has been on trial by the board of wireless telegraphy for some time. In addition, the cruisers Topeka and Prairie, which for some months have been conducting wireless tests from ship to ship, and from ship to shore, probably will be ordered to New England waters for the manoeuvres. These vessels will in the meantime be equipped each time with a set of instruments of the Lodge-Muirhead system.